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PERFORMANCE SPECIFICATION

FOR THE

MULTIPLE INTEGRATED LASER ENGAGEMENT SYSTEM (MILES) XXI TRAINING SYSTEM

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TABLE OF CONTENTS

1	SCOPE	1
1.1	SYSTEM DESCRIPTION	1
1.2	BACKGROUND	1
2	APPLICABLE DOCUMENTS	1
2.1	SPECIFICATIONS, STANDARDS AND HANDBOOKS	1
2.2	OTHER GOVERNMENT DOCUMENTS	2
2.3	CODE OF FEDERAL REGULATIONS	2
2.4	NON-GOVERNMENT STANDARDS AND PUBLICATIONS	2
2.5	ORDER OF PRECEDENCE	3
3	REQUIREMENTS	3
3.1	MILES XXI TRAINING SYSTEM DEFINITION	3
3.1.1	<i>MILES XXI System Prime Items</i>	4
3.1.1.1	First Article	4
3.1.2	<i>MILES XXI Interface</i>	5
3.1.2.1	Basic MILES Interface	5
3.1.2.2	Operator Interface	5
3.1.2.3	Data Transfer Interface	5
3.1.2.4	Host Interface	5
3.1.2.4.1	Vehicle Internal Communication Interface	5
3.1.2.4.2	Vehicle External Communication Interface	5
3.1.2.4.3	Weapon System Trigger Interface	6
3.1.2.4.4	Mechanical Interface	6
3.1.2.5	Direct/Indirect Fire Cue (DIFCUE) Interface	6
3.1.2.6	Main Gun Signature Simulator (MGSS) Interface	6
3.2	SYSTEM CHARACTERISTICS	6
3.2.1	<i>System Performance</i>	6
3.2.1.1	Shooter	7
3.2.1.2	Target System	9
3.2.1.3	BIT Characteristics	14
3.2.1.4	Computational System Requirements	15
3.2.1.4.1	Operational Computer Systems	15
3.2.1.4.2	Operational System Software	15
3.2.1.4.2.1	Software Development Requirements	15
3.2.1.4.2.2	Run Time Environment	16
3.2.1.4.2.3	Firmware	16
3.2.1.5	False Alarm Rate	16
3.2.1.6	Installation and Removal Requirements	16
3.2.1.7	Mounting	16
3.2.1.7.1	Mounting Devices	16
3.2.1.8	Interfacing Cabling	17
3.2.1.9	Transit Cases	17
3.2.2	<i>Physical characteristics</i>	17
3.2.2.1	Weight	17
3.2.2.2	Size	17

3.2.2.3 Power-----	17
3.2.2.3.1 Power Control -----	18
3.2.2.3.2 Power Operation -----	18
3.2.2.3.3 Batteries -----	19
3.2.2.4 Finish-----	19
3.2.2.5 Color -----	19
3.2.2.6 Transportability-----	19
3.2.3 <i>Reliability</i> -----	19
3.2.4 <i>Maintainability</i> -----	20
3.2.5 <i>Environmental conditions</i> -----	20
3.2.5.1 High Temperature -----	20
3.2.5.2 Low Temperature-----	20
3.2.5.3 Shock-----	20
3.2.5.4 Vibration-----	21
3.2.5.5 Humidity-----	21
3.2.5.6 Rain-----	21
3.2.5.7 Sand and Dust-----	21
3.2.5.8 Immersion -----	22
3.2.5.9 Corrosion -----	22
3.2.5.10 Salt and Fog -----	22
3.3 CONSTRUCTION -----	22
3.3.1 <i>Material and Parts</i> -----	22
3.3.2 <i>Electromagnetic Environmental Efforts</i> -----	22
3.3.2.1 Electromagnetic Environmental Effects (E3)-----	22
3.3.2.2 Intra-system EMC. -----	23
3.3.2.3 Inter-system EMC. -----	23
3.3.2.4 Electromagnetic Environment(EME). -----	23
3.3.2.5 Non-developmental items (NDI) and commercial items -----	24
3.3.2.6 Life cycle E3 hardness -----	24
3.3.2.7 Electromagnetic radiation hazards (EMRADHAZ)-----	25
3.3.2.8 Optical Interference -----	25
3.3.3 <i>Nameplates and product marking</i> -----	25
3.3.4 <i>Interchangeability</i> -----	25
3.3.5 <i>System Safety</i> -----	25
3.3.5.1 Electrical Safety -----	25
3.3.5.2 Hazardous Materials -----	26
3.3.5.3 Mechanical Safety-----	26
3.3.5.4 Personnel Safety-----	26
3.3.5.5 Ionizing Radiation-----	26
3.3.5.6 Laser Safety -----	26
3.3.5.7 Radioactive Material Restriction in Optical Products-----	27
3.3.6 <i>Human engineering</i> -----	27
3.3.6.1 Speech Intelligibility-----	27
3.4 MAJOR COMPONENT CHARACTERISTICS -----	27
3.4.1 <i>MILES XXI Combat Vehicle System</i> -----	27
3.4.2 <i>MILES XXI Independent Target System</i> -----	34
3.4.3 <i>MILES XXI Crew Served Weapon System</i> -----	35
3.4.4 <i>MILES XXI Individual Weapon System</i> -----	37
3.4.5 <i>MILES XXI Surrogate Weapon System</i> -----	40
3.4.6 <i>Controller Device</i> -----	41
3.4.7 <i>AAR System</i> -----	42
3.4.7.1 Upload/Download/Initialize Time -----	42
3.4.7.2 AAR System Storage Requirements -----	42
3.4.7.3 Personal Computer (PC) Compatibility -----	42
3.4.7.4 AAR System Software -----	42
3.4.8 <i>Boresight and Alignment Device(s)</i> -----	43
3.4.9 <i>Organizational Test Set(s)</i> -----	43

4	VERIFICATION	44
4.1	DESIGN VERIFICATION	44
4.2	VERIFICATION METHODS	47
4.2.1	<i>Operational System Software</i>	47
4.2.1.1	Software Development Requirements	47
4.2.1.2	Firmware	47
4.2.2	<i>Transit Cases</i>	47
4.2.3	<i>Transportability</i>	47
4.2.4	<i>Reliability</i>	48
4.2.5	<i>Maintainability</i>	48
4.2.6	<i>Environmental Conditions</i>	48
4.2.6.1	High Temperature	48
4.2.6.2	Low Temperature	49
4.2.6.3	Shock	50
4.2.6.4	Vibration	50
4.2.6.5	Humidity	52
4.2.6.6	Rain	52
4.2.6.7	Sand and Dust	53
4.2.6.8	Immersion (Leakage)	53
4.2.6.9	Corrosion	54
4.2.6.10	Salt and Fog	54
4.2.7	<i>Electromagnetic Environmental Effects (E3)</i>	54
4.2.7.1	E3 verification methods.	55
4.2.7.2	Intra-system EMC.	55
4.2.7.3	Inter-system EMC.	55
4.2.7.4	Non-developmental items (NDI) and commercial items.	55
4.2.7.5	Life cycle, E3 hardness.	55
4.2.7.6	Electromagnetic radiation hazards (EMRADHAZ).	55
4.2.8	<i>Interchangeability</i>	55
4.2.9	<i>System Safety</i>	56
4.2.9.1	Electrical Safety	56
4.2.9.2	Hazardous Materials	56
4.2.9.3	Mechanical Safety	56
4.2.9.4	Personnel Safety	57
4.2.9.5	Ionizing Radiation	57
4.2.9.6	Laser Safety	57
4.2.9.7	Radioactive Material Restrictions in Optical Products	57
4.2.10	<i>Target Visual Kill Status Observation</i>	58
4.3	FIRST ARTICLE INSPECTION	58
5	PACKAGING	58
5.1	PACKAGING	58
6	NOTES	58
6.1	ADAPTABILITY	58
6.2	ABBREVIATIONS AND ACRONYMS	59
APPENDIX A		A-1
APPENDIX B		B-1
APPENDIX C		C-1

APPENDIX D-----	D-1
APPENDIX E-----	E-1

1 SCOPE

This performance specification defines the performance requirements of the Multiple Integrated Laser Engagement System (MILES) XXI Training System.

1.1 SYSTEM DESCRIPTION

The MILES XXI requirement is for the replacement of the existing U.S. army direct fire ground based MILES devices (Basic MILES) with the laser-based Tactical Engagement Simulation (TES) training devices. All MILES XXI systems and devices will be downwardly operational compatible with the Basic MILES and MILES 2000 training devices. The MILES XXI system will be fielded worldwide and used in all geographical areas. The MILES XXI will not require no new manpower assets, personnel requirements, or qualifications.

1.2 BACKGROUND

The family of the Basic MILES was developed in the early 1980's using technology and designs then available. The Army has identified the need for enhanced force-on-force simulation of armor and anti-armor devices. The enhancements will include player identification (PID), fratricide identification, multiple levels of kill, and vulnerability due to direction of attack. New weapons, ammunition, and weapon performance will be accommodated.

2 APPLICABLE DOCUMENTS

The following documents shown below form a part of this Specification to the extent specified herein.

2.1 SPECIFICATIONS, STANDARDS AND HANDBOOKS

The following specifications, standards, and handbooks form a part of this document to the extent specified herein.

MILITARY STANDARDS

MIL-STD-810E Notice 3	Environmental Test Methods and Engineering Guidelines
MIL-STD-1553B Notice 4	Digital Time Division Command/Response Multiplex Data Bus
MIL-STD-1472F	Human Engineering Design Criteria for Military Systems, Equipment and Facilities

(Unless otherwise indicated, copies of the above specifications, standards, and handbook are available through: <http://astimage.daps.dla.mil/quicksearch/>).

2.2 OTHER GOVERNMENT DOCUMENTS

The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein.

PMT 90-S002G	MILES Communication Code (MCC97) Standard
19207-12465074H	M2A3/M3A3 Interface Control Document for External Training Devices
9721802D	Prime Item Function Specification for the Keyless Main Gun Signature Simulator (MGSS)
9721801C	Prime Item Function Specification for the Keyless Direct/Indirect Fire Cue (DIFCUE)

(Unless otherwise specified copies of other Government documents, drawings and publications are available from: http://www.stricom.army.mil/PRODUCTS/MILES_XXI/)

2.3 CODE OF FEDERAL REGULATIONS

The following code of federal regulations form a part of this document to the extent specified herein.

10 CFR 40	Domestic Licensing of Source Material
21 CFR 40	Performance Standards for Light-Emitting Products

(Unless otherwise specified copies of code federal regulations are available from: <http://www.access.gpo.gov/nara/cfr/cfr-table-search.html>)

2.4 NON-GOVERNMENT STANDARDS AND PUBLICATIONS

The following documents form a part of this document to the extent specified herein.

ANSI/NFPA 70-02	National Electrical Code
Air Transport Association of America (ATA)	
ATA SPEC 300	Packaging of Airline Supplies (Revision 18)
American National Standards Institute (ANSI)	
ANSI Z136.1-2000	Safe Use of Laser (Revision of ANSI Z136.1-1993)
ANSI/NEMA Z535.3	Criteria for Safety Symbols

ANSI/NEMA Z535.4 Product Safety Sign and Labels

(Unless otherwise specified copies of above documents are available from:
<http://www.nssn.org/search.html>)

2.5 ORDER OF PRECEDENCE

In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supercedes applicable laws and regulations unless a specific exemption has been obtained.

3 REQUIREMENTS

3.1 MILES XXI TRAINING SYSTEM DEFINITION

The MILES XXI Training System shall:

- a. Consist of a family of laser based training devices appended to foot soldiers, crew served ground weapons, ground vehicle weapon systems, and targets such as High Mobility Multipurpose Wheeled Vehicle (HMMWV), trucks, bunkers, and bridges.
- b. Have a modular design with the flexibility to permit upgrading of the training system to accommodate product improvements to the host weapons platform.
- c. Simulate each herein specified weapon and ammunition effect on a MILES XXI equipped system.
- d. Interface and be compatible with MILES training devices in accordance with (IAW) PMT 90-S002G.
- e. Provide an external RS-232 serial interface to provide the capability to send and receive real-time data necessary to interface to the Combat Training Centers (CTCs). The external RS232 interface will be the same interface used for after action review. The Combat Vehicle System (CVS) and the Direct Fire Vest (DFV) RS 232 interface ports will utilize common: connectors, signal lines, and pin assignments. The signals as a minimum will consist of transmit (Tx), receive (Rcv), and signal return (Ret). The CVS will operate asynchronously while the DFV may operate synchronously, using a polling process, with the DFV acting as a master bus controller. The DFV will be capable of polling the CTC side of the interface at a maximum rate of 1 cycle per second. The CVS and DFV RS 232 ports will operate at baud rates between 2400 to 19200 with 1 start bit, 8 data bits, and 1 stop bit. Standard RS232 12 volt signal levels will be utilized.

- f. As the result of a weapon trigger pull in an engagement, transmit messages that contain a unique PID code and the weapon and ammunition code in accordance with (IAW) PMT 90-S002G.
- g. Assess the lethality effects of the engagement on the MILES XXI system engaged.
- h. Trigger the specified visual and audio cues.
- i. Store engagement data in electronic media for retrieval and use in After Action Reviews (AARs).
- j. Be programmable using an external programming source that does not require opening system devices or removing system components.
- k. Provide ancillary devices to boresight lasers to weapon systems.
- l. Provide administrative control functions
- m. Be easy to maintain and service with minimum personnel, materiel, parts, special tools, and equipment.

3.1.1 MILES XXI SYSTEM PRIME ITEMS

The MILES XXI Training System shall consist of the following prime items:

- a. MILES XXI Combat Vehicle System
- b. MILES XXI Independent Target System
- c. MILES XXI Crew Served Weapon System
- d. MILES XXI Individual Weapon System
- e. MILES XXI Surrogate Weapon System
- f. After Action Review (AAR) System
- g. Controller Device
- h. Ancillary Devices

3.1.1.1 FIRST ARTICLE

When specified, a sample shall be subjected to first article inspection.

3.1.2 MILES XXI INTERFACE

Each MILES XXI Laser Transmitter Unit and Controller Device shall interface with the MILES XXI Laser Detector Units by way of a laser light beam communication channel through the atmosphere IAW PMT 90-S002G.

3.1.2.1 BASIC MILES INTERFACE

Each MILES XXI device shall interface and be compatible with MILES Training Devices by way of the specified laser communication channel through the atmosphere IAW PMT-90-S002G.

3.1.2.2 OPERATOR INTERFACE

Each MILES XXI system and device shall interface with individual operators, crews, and controllers to input data and select system parameters to the MILES XXI systems and to receive the system data from the MILES XXI system.

3.1.2.3 DATA TRANSFER INTERFACE

Each MILES XXI system shall provide an external data input/output (I/O) interface via an industry standard interface protocol to meet the specific timing requirements. The data transfer interface shall allow for the download of event data from the MILES XXI systems, the upload of PID, weapon characteristics, and vulnerability data and the download of events data to a PC, laptop computer, Personal Digital Assistant (PDA), or similar device.

3.1.2.4 HOST INTERFACE

MILES XXI systems shall interface optically, electronically, and mechanically with host vehicles systems, weapons systems, and operators.

3.1.2.4.1 VEHICLE INTERNAL COMMUNICATION INTERFACE

The Combat Vehicle system shall inject alert tones and aural messages into the vehicle internal communications system. For the Bradley M2A3/M3A3 the Combat Vehicle System shall inject the appropriate messages onto the vehicles 1553 bus to initiate the generation of the appropriate voice messages by the vehicle, IAW 19207-1246074 REV H, M2A3/M3A3 Interface Control Document for External Training Devices. No permanent modifications to the vehicles will be permitted.

3.1.2.4.2 VEHICLE EXTERNAL COMMUNICATION INTERFACE

The external communication of the Combat Vehicle System is not required to be interrupted when a catastrophic kill or communication kill is assessed

3.1.2.4.3 WEAPON SYSTEM TRIGGER INTERFACE

The Combat Vehicle System Laser Transmitter Unit shall interface and provide electronic isolation with the primary weapon trigger circuitry of the vehicles defined in Appendix A. For the Crew Served Weapon System defined in Appendix A that utilizes the actual components of the Crew Served Weapon being simulated, the corresponding Laser Transmitter Unit shall interface with the weapon trigger circuitry. The interface shall protect the weapon trigger circuitry from current sags, surges, and transients resulting from the interface with the MILES XXI system.

3.1.2.4.4 MECHANICAL INTERFACE

The MILES XXI systems shall be appended to vehicle systems, weapon systems, individual operators, and other structures such as bunkers, bridges, and buildings.

3.1.2.5 DIRECT/INDIRECT FIRE CUE (DIFCUE) INTERFACE

The Combat Vehicle System shall interface with the DIFCUE, Device number 06-69. The Combat Vehicle System shall provide a signal to trigger the DIFCUE when a catastrophic kill has been assessed. The Combat Vehicle System operation, with the exception of the DIFCUE not firing, shall not be affected when the DIFCUE system is not connected.

3.1.2.6 MAIN GUN SIGNATURE SIMULATOR (MGSS) INTERFACE

The M1A1 and M1A2 MILES XXI Combat Vehicle System shall interface with the MGSS, Device number 17-180. When simulating the firing of the main gun, the M1A1 and M1A2 MILES XXI Combat Vehicle System shall transmit a signal to activate the MGSS. The Combat Vehicle System operation, with the exception of the MGSS not firing, shall not be affected when the MGSS system is not connected.

3.2 SYSTEM CHARACTERISTICS

3.2.1 SYSTEM PERFORMANCE

The MILES XXI training system shall provide force-on-force engagement simulations to obtain feedback on the effects of direct fire weapon engagement simulations on personnel, independent targets, crew served weapons, and combat vehicles. MILES XXI shall have the capability for use during periods of reduced visibility and darkness within the capabilities of the weapons with which it is being used. The casualty assessments shall pair attackers and their targets. The engagement results shall be indicated to the target and attacker using visual and audible cues.

3.2.1.1 SHOOTER

The MILES XXI Shooter shall:

a. Transmit weapon engagement data, including armor kill code words, man kill code words, near miss code words, ammunition type, and PID, which allows Probability of Kill assessments.

b. Transmit the MILES XXI PID that allows pairing between the shooter and the target.

c. Be downward MILES compatible by:

(1) Projecting a laser beam(s) to produce out to the effective range the hit "footprint" onto a target for each weapon and its ammunition being simulated as listed in Appendix A. The laser beam hit "footprint" shall convey ammunition type, PID, and the number of man and armor kill words as specified in PMT-90-S002G,

(2) Projecting a laser beam(s) to produce out to the effective range the near miss "footprint" onto a target for each weapon and its ammunition being simulated as listed in Appendix A. The laser beam near miss "footprint" shall be larger than the laser beam hit "footprint" and shall convey ammunition type, PID, and the number of near miss words as specified in PMT-90-S002G. The near miss mode shall not apply to missile weapons.

(3) Transmitting engagement data encoded on the laser beam for shooter to target pairing with the pairing probabilities. The aim point for the Laser Transmitter shall be the center of the target profile. The MILES XXI training system, the atmospheric conditions are defined as a maximum visibility of 23.5 Km, wind speed of 2.5 ± 2.5 KMPH, a relative humidity of 55 ± 15 percent and the following temperatures:

(a) For a temperature of 25 ± 5 degrees C,

1) With the exception of the M240, M249, and M2 a minimum of 95% pairing probability out to 90% of the weapon's effective range as listed in Appendix A. A casualty assessment indication on the target is considered a pairing.

2) For the M240, M249, and M2, a minimum of 85% pairing probability with a group of three MILES XXI targets out to 90% of the weapon's effective range as listed in Appendix A. Each engagement shall consist of the weapon being fired in burst mode consisting of six to nine shots. Targets shall be placed side by side, with 1 ± 0.1 meter between the center of each target. A casualty assessment indication on any of the targets is considered a pairing.

3) For the M240, and M2, a minimum of 85% pairing probability with a group of three MILES XXI targets out to 90% of the weapon's suppression range as listed in Appendix A. Each engagement shall consist of the weapon being fired in burst mode

consisting of six to nine shots. The targets shall be placed side by side, with 1 ± 0.1 meter between the center of each Laser Detection System. A casualty assessment or near miss indication on any of the Laser Detection Systems is considered a pairing.

4) With the exception of the M240, and M2, a pairing probability of less than 20% with each MILES XXI Laser Detection Unit for ranges greater than 170% of the weapon's effective range as listed in Appendix A. A casualty assessment indication on the target is considered a pairing.

5) For the M240 and M2, a pairing probability of less than 20% with each MILES XXI target for ranges greater than 130% of the weapon's suppression range as listed in Appendix A. A casualty assessment indication on any of the targets is considered a pairing.

(b) For a temperatures between -18 and 20 degrees C and between 30 and 49 degrees C,

1) With the exception of the M240, M249, and M2, a minimum of 90% pairing probability with each MILES XXI target out to 90% of the weapon's effective range as listed in Appendix A. A casualty assessment indication on the target is considered a pairing.

2) For the M240, M249, and M2, a minimum of 80% pairing probability with a group of three MILES XXI targets out to 90% of the weapon's effective range as listed in Appendix A. Each engagement shall consist of the Laser Weapon Simulator being fired in burst mode consisting of six to nine shots. Targets shall be placed side by side, with 1 ± 0.1 meter between the center of each target. A casualty assessment indication on any of the targets is considered a pairing.

3) For the M240 and M2, a minimum of 80% pairing probability with a group of three MILES XXI targets out to 90% of the weapon's suppression range as listed in Appendix A. Each engagement shall consist of the Laser Weapon Simulator being fired in burst mode consisting of six to nine shots. Targets shall be placed side by side, with 1 ± 0.1 meter between the center of each target. A casualty assessment or near miss indication on any of the targets is considered a pairing.

4) With the exception of the M240 and M2, a pairing probability of less than 25% with each MILES XXI target for ranges greater than 170% of the weapon's effective range as listed in Appendix A. A casualty assessment indication on the target is considered a pairing.

5) For the M240 and M2, a pairing probability of less than 25% with each MILES XXI target for ranges greater than 130% of the weapon's suppression range as listed in Appendix A. A casualty assessment indication on any of the targets is considered a pairing.

(c) Transmit the Weapon Simulator laser light beam at a wavelength of 904.5 \pm 25 nanometers.

d. Have no external power switches.

e. Include firing system delays for trigger pull time and actual firing time. The MILES XXI system shall inhibit the firing of successive rounds until time has expired between rounds to simulate reloading the weapon and simulate the limitations imposed by the weapon's maximum rate of fire as listed in Appendix A.

f. Provide a means of aligning and boresighting the system to the weapon system, if required to meet pairing and boresight retention requirements, within 15 minutes or less with at least a 10 hour boresight retention under training exercise conditions.

g. Provide a single shot dry fire trigger unit to provide the ability to activate Shooter for pairing without firing blank ammunition.

h. Provide the firer with an indication that the device is firing properly.

3.2.1.2 TARGET SYSTEM

IAW PMT 90-S002G, the MILES XXI Target Systems shall:

a. Decode the following Laser Transmitter Unit messages:

- (1) Weapon Type
- (2) Ammo Type
- (3) PID

b. Be compatible with Laser Transmitter codes fired from MILES systems and:

(1) Detect the encoded laser beam transmitted by the MILES XXI Laser Transmitter in ambient illumination ranging from darkness to full sunlight.

(2) Utilize detectors with maximum response centered in the 904.5 \pm 25 nanometers range.

(3) Pair throughout 360 degrees of detection coverage in azimuth and \pm 45 degrees of detection coverage in elevation off the centerline of the target.

(4) Create a statistical shot pattern that meets the requirements below:

(a) The statistical hit profile for the front, back, and sides of the Combat Vehicle System and Independent Target System shall consist of a collection of aim points that pair the MILES armor kill words and PID from the following Laser Weapon Simulator

(man kill words for the 25mm) with the corresponding Target System. The profile dimensions when measured at the midpoint of the Weapon's effective range shall attempt to replicate the actual shape of the vehicle. The profile shall be larger than a circle with a diameter of one meter and shall fit inside a concentric circle with a diameter of 8.5 meters.

Laser Transmitter(s)		Laser Target System
120mm, 25mm, vehicle TOW	Vs.	Combat Vehicle System
120mm, 25mm, vehicle TOW	Vs.	Independent Target System
TOW	Vs.	Combat Vehicle System
TOW	Vs.	Independent Target System
AT4	Vs.	Combat Vehicle System
AT4	Vs.	Independent Target System

(b) The statistical hit profile for the front and back of the Manworn Unit and the sides of the Crew Served Weapon shall consist of a collection of aim points that pair the MILES man kill words and PID from the following Laser Weapon Simulator with the corresponding Target System. This profile, when measured in the dryfire mode at the midpoint of the Weapon's effective range, shall be larger than a circle with a diameter of 0.2 meters and shall fit inside a rectangle measuring 1.5 meters in the horizontal plane and 2.5 meters in the vertical plane.

Laser Transmitter(s)		Target System(s)
M16A2, M24, M240, M249, M2	vs.	Manworn Unit
M16A2, M24, M240, M249, M2	vs.	Crew Served Weapon System

(5) Process the electronic signals to decode the MILES code messages IAW PMT-90-S002G. After the reception of 22 missile code messages within ten seconds, the initiation of the kill/near miss determination shall not be dependent on the decoder's ten second tracking interval window.

c. Contain externally programmable Probability of kill (Pk) data per PMT-90-S002G, for each MILES code number.

d. Process the decoded message in conjunction with a Pk factor in a MILES XXI lethality algorithm and the target/weapon hierarchy specified in PMT-90-S002G to assess the effect of the attacking weapon on the attacked MILES XXI system.

e. Generate the following audio and visual signals to trigger the following actions upon completion of casualty assessment effect on a target:

(1) Two flashes for Combat Vehicle System and Independent Target System's near miss indication.

- (2) Two tones for Crew Served Weapon System and Manworn Unit's near miss indication.
 - (3) Four flashes for the Combat Vehicle System and Independent Target System hit and communication kill indication, and the Combat Vehicle System firepower kill indication.
 - (4) Four flashes for the Combat Vehicle System and Independent Target System's mobility kill indication.
 - (5) Continuous flashing for the Combat Vehicle System and Independent Target System's catastrophic kill indication.
 - (6) Continuous tones for the Crew Served Weapon System and Manworn Unit's kill indication.
- f. Process the PID portion of each engagement message group for linkage with lethality assessment.
 - g. Provide with an internal clock containing day, month, year, and time information synchronized by the Controller Device to a 30 second accuracy in a 96 hour period. The time display format shall be XXYYZZ or XX:YY:ZZ—where XX represents hours (00-24), YY represents minutes, and ZZ represents seconds. For the IWS, the omission of seconds from some displays is acceptable, however the time recorded for AAR purposes must include seconds for all events. The AAR shall display time in the format XXYYZZ or XX:YY:ZZ, where XX represents hours (00-24), YY represents minutes, and ZZ represents seconds.
 - h. Record and store MILES XXI events that occur during a training exercise. The event recorder shall have sufficient memory capacity for storing the data of the last 500 events. Recorded data shall be retained under low power conditions and battery removal. The event data fields to be stored shall include the following:
 - (1) Initiation events, to include power up.
 - (a) Synchronized time of event
 - (b) Host platform PID
 - (c) Host platform type (vehicle only)
 - (d) Weapon/ammunition type (vehicle only)
 - (e) Ammunition Load Count (vehicle only)
 - (f) Built In Test (BIT) results
 - (2) Firing events, Combat Vehicle (Primary Weapons Only), and Crew Served Weapon Systems.
 - (a) Synchronized time of event

- (b) Host platform PID
- (c) Weapon type
- (d) Ammunition type
- (e) Ammunition remaining

(3) Lethality assessment events, to include hit, mobility kill, communication kill, firepower kill, catastrophic kill, and near miss.

- (a) Synchronized time of event
- (b) Lethality assessment
- (c) PID of attacker
- (d) Weapon and ammunition type (Ammo type N/A for Near Miss and Small Arms)
- (e) Aspect Angle of attack (Vehicle only)
- (f) Turret position (Turreted vehicles only)
- (g) Determination of fratricide by comparison of shooter and target PID

(4) Cheat Events, to include tampering attempts and motion after mobility kills.

- (a) Synchronized time of event
- (b) Cheat category description

(5) Administrative events, to include time synchronization, administrative kills, resurrect, and commanded BIT results.

- (a) Synchronized time of event
- (b) Administrative category description

i. When a casualty has been assessed, during both day and night conditions, display the weapon type causing casualty and the casualty assessment. The message shall remain displayed for 7.5 ± 2.5 seconds.

j. Visually display, upon recall, no less than the 16 most recently recorded events. The scrolled messages shall remain displayed for 7.5 ± 2.5 seconds. At a minimum, the following information shall be available for display:

- (1) Results of last event (Kill/hit/near-miss)
- (2) PID of attacking player/weapon system when killed
- (3) Low battery indication
- (4) BIT failure (by type)

(5) Ammunition remaining by weapon, quantity and type, for Combat Vehicle Systems only

(6) Platform type (vehicle only) and PID

(7) Synchronized time of an event in military format to nearest second

k. Provide an interface that shall be used to manually select a vehicle type and ammunition load for the Combat Vehicle and Independent Target Systems. This action shall require controller personnel interaction and shall not be independently available to the crew.

l. Allow transfer of the stored event data.

m. Allow download of vulnerability Pks and other data that programs the device to allow it to assume the role and performance characteristics of the system on which it will be installed. The data to be transferred shall include the following:

(1) OPFOR PID

(2) BLUEFOR PID

(3) Basic Ammunition Default Load (All primary weapons of the Combat Vehicle System and the Crew Served Weapon System)

(4) Ammunition type (All primary weapons of the Combat Vehicle System and Crew Served Weapon System)

(5) Ammunition delay time (All primary weapons of the Combat Vehicle System and the Crew Served Weapon System)

(6) Vulnerability and Pk data

(7) Capability to prevent the host system from assessing a kill from its own encoded laser transmission.

n. Provide a low power indication.

o. Provide a means to detect player efforts to inhibit MILES XXI system equipment performance. Whenever the player tampers with a MILES XXI system to interfere with normal power supply, cable connections, detectors, semi-permanent memory data storage unit, and controller's interface when it is locked to the player, the system shall detect a tamper attempt and perform a kill on the MILES XXI system. The tamper attempt shall be stored in the event storage.

- p. Return the MILES XXI system units to a full operational state without altering the count of remaining ammunition and stop any casualty assessment indication when the Target System detects and decodes the resurrection command.
- q. Return the MILES XXI system units to a full operational state, stop any casualty assessment indication, and return ammunition loads to the default level, for Combat Vehicle Systems only, when the target system decodes the reset command from the MILES XXI Controller Device.
- r. Retain all stored information for a minimum of 96 hours, regardless of system power status.
- s. Contain an event memory clear function to allow only controller personnel to clear the event memory.
- t. Perform a MILES catastrophic kill at the time of system power up.

3.2.1.3 BIT CHARACTERISTICS

A built-in fault detection and locating system shall be provided to detect performance degradation and failures and provide GO/ No Go status for all MILES systems. BIT features shall include the following:

- a. Provide an assessment of overall system integrity in not more than 1 minute upon command.
- b. Diagnose problems and faults to at least the major component level (excluding vehicle mounting hardware, and transit cases).
- c. All MILES XXI systems and devices which use battery power, except for the Bradley ATWESS Firing Fixture (BAFF), the IWS helmet harness, and the IWS vest harness amplifier, shall have a method to self test the battery power level for immediate operation without the use of special tools or modification. This test shall be performed automatically upon battery insertion and shall notify the operator of the battery power status.
- d. Function on-line, shall be entirely self-contained, and shall require no external measurement equipment.
- e. Display the results of BIT to the MILES XXI system operator when the system has completed an integrity checkout.
- f. Power On BIT - All MILES XXI systems shall automatically initiate a complete BIT sequence in response to powering up the system with results indicated.

g. Manual BIT - All MILES XXI systems shall initiate a complete BIT sequence in response to a request from the system operator.

3.2.1.4 COMPUTATIONAL SYSTEM REQUIREMENTS

The MILES XXI computational system shall consist of computer systems and system software.

3.2.1.4.1 OPERATIONAL COMPUTER SYSTEMS

The operational computer systems shall consist of one or more commercial item processors and peripherals, interface hardware, controllers, and cables. Each processor shall have a word size, operating speed, installed memory, and bus bandwidth to fulfill the system requirements and spare capacity requirements of this Specification. The operational computer system(s) shall provide the following spare resources to allow for expansion and modification. Spare requirements shall be met during worst-case system operating conditions where maximum demands are placed on processors, memories, and I/O channels. The required spare resources are as follows:

a. Spare memory. The system shall provide spare memory for each processor equal to 30% of the installed memory for that processor. Spare memory for any shared memory equal to 30% of the installed memory shall also be provided. All installed spare memory shall be directly addressable by the delivered processor and operating system.

b. Spare I/O Capacity. The spare I/O channel throughput capacity shall equal or exceed 50% of the total installed I/O channel capacity.

3.2.1.4.2 OPERATIONAL SYSTEM SOFTWARE

The operational system software shall consist of one or more of the following: developed software, reusable software, commercial item software, and modified previously-developed software. The system software shall consist of applications programs, support programs, and control programs required to meet the performance requirements.

3.2.1.4.2.1 SOFTWARE DEVELOPMENT REQUIREMENTS

Software procured under this Contract shall have been developed using recognized modern software engineering methods, and using a commercial item programming language and compiler. All machine dependent code and compiler dependent code shall be logically grouped into separate packages with meaningful names. Adaptation of previously-developed software to make it fully compliant with the MILES XXI requirements shall also be accomplished using recognized modern software engineering methods.

3.2.1.4.2.2 RUN TIME ENVIRONMENT

If used, the run time environment shall consist of a commercial item real-time operating system.

3.2.1.4.2.3 FIRMWARE

Code or data which is stored in hardware devices (e.g., in a Programmable Read Only Memory) is software and shall be incorporated into the appropriate Computer Software Configuration Items (CSCI) with the same requirements as other software.

3.2.1.5 FALSE ALARM RATE

The MILES XXI training system shall have a cumulative false alarm rate of not more than one false alarm per 100 hours of field operations for each of the following quantities of MILES XXI systems:

- a. 100 Individual Weapon Systems
- b. 50 Combat Vehicles Systems
- c. 50 Independent Target Systems
- d. 50 Crew Served Weapon Systems

3.2.1.6 INSTALLATION AND REMOVAL REQUIREMENTS

All MILES XXI systems shall be installed, operated, and removed without physical damage to or permanent modification of the host vehicle and weapon system.

3.2.1.7 MOUNTING

MILES XXI system components that are mounted in host vehicles shall be out of the way of crew operators and shall be as transparent as possible to the crew.

3.2.1.7.1 MOUNTING DEVICES

Mounting devices shall include all devices required to secure MILES XXI system components to the host platform. For vehicles, mounting devices shall electronically and mechanically couple into the host vehicle system for a training exercise. Fasteners manipulated by the soldiers in the field shall be of the captive type.

3.2.1.8 INTERFACING CABLING

Interfacing devices shall include electrical cables, connectors, and couplers to interconnect MILES XXI system components with each other. The cables, connectors, and couplers to interconnect Combat Vehicle System and Independent Target System components to the host vehicle systems shall be provided. All cables attached to either the vehicle or targets shall be by temporary means. All MILES XXI cables shall be clearly marked with designated function, cable part number, connector numbers, and reference designator. Connectors shall be color coded for installation when both mating connectors are being provided within the MILES XXI system.

3.2.1.9 TRANSIT CASES

The MILES XXI device and system level transit cases shall be used to protect MILES XXI components during transportation, storage, and handling. Where practical, the cases shall hold all the components of one or more kits of a particular configuration. The transit cases shall be built to comply with ATA SPEC 300, category I container. The transit case shall provide protected areas for attachment of all hardware. Top and bottom case surfaces shall be interlocking. Transit cases requiring a four-man lift shall have handles on all four sides.

3.2.2 PHYSICAL CHARACTERISTICS

3.2.2.1 WEIGHT

All MILES XXI component assemblies shall be transportable and maneuverable by one man. When assembled in their respective operating configuration, the weight of each MILES XXI component shall not exceed that prescribed by the lift and carry requirements. The weight and center of gravity of the MILES XXI devices shall not impede the carrying, movement and functioning abilities of the individual or crew in conducting training.

3.2.2.2 SIZE

The MILES XXI system components and devices shall be minimized such that they do not impede the carrying, movement, and functioning abilities of the individual, crew, and host platform in conducting training.

3.2.2.3 POWER

All MILES XXI system and devices shall have a self- contained power system or be powered by the vehicle's power supply system. If powered by host vehicle power, a self-contained backup power source, independent of the vehicles power supply system, shall be provided. For systems and devices not operated by the vehicle's power supply, a commercially available power source shall be used.

3.2.2.3.1 POWER CONTROL

The MILES XXI power supply shall satisfy the following power control requirements:

a. The Combat Vehicle System and Independent Target System shall have an on/off function which restores/inhibits the power from the source to the system. The on/off function shall have a guard to prevent accidental actuation.

b. All MILES XXI components that receive their primary power from a host vehicle power supply system shall perform the following functions:

(1) Operate with and provide a means of protection from vehicle battery voltage and current sags, surges and transients.

(2) Operate within the range of 16 to 33 volts DC, with surges up to 40 volts, with a peak ripple of 7 volts containing a ripple frequency between 50 Hz and 200 kHz.

(3) Provide transient protection in addition to the conducted susceptibility requirements. The transient protection shall be capable of handling a transient of both positive and negative 250 volts with a rise time of 50 nanoseconds recurring at the rate of one transient per second. For these tests, simulated voltage spikes shall be applied to the equipment while it is operating at nominal voltage. The test spike shall have an amplitude of 250 V, a risetime not exceeding 50 nanoseconds, a frequency of oscillation greater than 100 kHz and less than 500 kHz and an energy content of not less than 15 millijoules.

(4) Automatically switch to an auxiliary battery in the event of the loss of vehicle power. In the event of loss of vehicle power, the MILES XXI system shall remain operational with no interruption in performance.

3.2.2.3.2 POWER OPERATION

The MILES XXI power supply shall satisfy the following power operation requirements:

a. The Individual Weapon Laser Transmitter Unit(s) shall be powered by a power source which shall implement a minimum of 10,000 shots over a period of 100 hours of field use before power source replacement is required. The Crew Served Weapon System and Surrogate Weapon System Laser Weapon Simulators(s) shall be powered by a power source which shall implement a minimum of 60 shots over a period of 100 hours of field use before power source replacement is required.

b. The Target System shall provide a minimum of 100 hours of continuous operation without power source replacement when powered from vehicle power. When powered only from the auxiliary battery, the Target System shall be capable of continuous operation for a minimum of 48 hours for the ITS kit, 27 hours for the Bradley vehicles, 30 hours for the M1 series Abrams tanks, and 34 hours for the M113A3 APC, while sustaining at least 20 near miss assessments per day and 1 catastrophic kill per day. When operating solely on

auxiliary battery power, the KSI shall flash for a minimum of ten minutes when a catastrophic kill is assessed.

3.2.2.3.3 BATTERIES

If field replaceable non-rechargeable batteries are used as a power source for a system or device, they shall be easily accessible to the operator or maintenance personnel without need for special tools. The batteries intended to be changed by field personnel shall take no more than one minute to replace.

3.2.2.4 FINISH

All exterior surfaces of MILES XXI components and devices shall be treated to resist corrosion or deterioration due to exposure to the elements.

3.2.2.5 COLOR

Selection of color for all painted surfaces shall be the low visibility, lusterless, nonreflective type. The color of the components mounted on vehicles or personnel shall be green or black, with the exception of surfaces required for the transmission or reception of electromagnetic signals.

3.2.2.6 TRANSPORTABILITY

Lift limits for devices shall be: One man - 56 pounds, Two-man - 112 pounds, Three-man - 154 pounds, Four-man - 196 pounds. Devices exceeding one man lift limits shall be prominently labeled with the total weight and required number of handlers. All MILES XXI systems, when packed in their transit cases, shall withstand damage due to stresses incidental to movement, handling in transit, and tie-down aboard common carrying vehicles such as aircraft or trucks.

3.2.3 RELIABILITY

Each MILES XXI system and device shall have a minimum acceptable Mean Time Between Essential Functional Failure (MTBEFF) requirement as shown below.

MTBEFF of Each MILES XXI Device

DEVICE	MTBEFF (HRS)
Combat Vehicle System	480
Independent Target System	910
Crew Served Weapon System	950
Individual Weapon System	690
Surrogate Weapon System	690
Controller Device	1900
AAR System	500

3.2.4 MAINTAINABILITY

The maximum acceptable Mean Time to Repair (MTTR) for each MILES XXI system and device shall be 60 minutes or less. All equipment shall be easy to maintain and service.

3.2.5 ENVIRONMENTAL CONDITIONS

Devices and component parts, units, and subassemblies of MILES XXI shall operate and be stored under the environmental conditions as follows:

3.2.5.1 HIGH TEMPERATURE

MILES XXI system components and devices shall comply with the following temperature requirements:

- a. Externally Mounted components shall operate in an environment with a maximum temperature of 49 degrees Celsius and Solar Loading of 1120 W/m².
- b. All internally-mounted components shall operate in an environment with a maximum temperature of 49 degrees Celsius.
- c. All internal and external components shall operate after being stored in an environment with a maximum temperature of 70 degrees Celsius.

3.2.5.2 LOW TEMPERATURE

Minimum operating temperature shall be -18 degrees C and the minimum storage temperature shall be -33 degrees C.

3.2.5.3 SHOCK

MILES XXI components and devices shall not be damaged when subjected to the specified shock spectrum of MIL-STD-810E NOTICE 3, Method 516.4, Procedure I - Functional Shock.

Components and devices in their transit cases shall not be damaged when subjected to the recommended drop test of Table 516.4-II and Procedure IV - Transit Drop.

3.2.5.4 VIBRATION

MILES XXI components and devices shall not be damaged when subjected to the specified vibration limits of MIL-STD-810E Notice 3. The requirements of MIL-STD-810E Notice 3 shall be as follows:

- a. The Combat Vehicle System components and Independent Target System components shall not be damaged when subjected to Method 514.4, Category 8 (Ground Mobile).
- b. The Crew Served Weapon System components, Surrogate Weapon System Components, AAR System, and Small Arms Alignment Fixture shall continue to function after being subjected, in their transit cases, to Method 514.4, Category 3 (Loose Cargo). Individual Weapon System components and the Controller Device shall continue to function after being subjected, without transit cases, to Method 514.4, Category 3 (Loose Cargo).

3.2.5.5 HUMIDITY

MILES XXI component and devices shall not be damaged during operations under relative humidity conditions up to 100%.

3.2.5.6 RAIN

MILES XXI components, devices, and all transit cases shall not be damaged when subjected to the following limits. Those components and devices subjected to the immersion test shall not be subjected to the rain test.

Rainfall rate:	10 centimeter/hour
Droplet size:	0.5 millimeter to 4.5 millimeters
Wind velocity:	64 kilometers/hour

3.2.5.7 SAND AND DUST

MILES XXI components and devices shall not be damaged when subjected to the following limits:

Blowing dust air velocity:	8.9 meters/second
Dust concentration:	10.6 \pm 7 g/cubic meters
Dust composition:	Silicon Flour

MILES XXI externally mounted Combat Vehicle System and Independent Target System components and devices shall not be damaged when subjected to the following limits:

Blowing sand air velocity: 29 meters/second
Sand concentration: 1.1 \pm 0.25 g/cubic meters

3.2.5.8 IMMERSION

The Individual Weapon Systems, all Combat Vehicle System components mounted on the exterior of the vehicle, and all Independent Target System Components mounted on the outside of the target shall show no evidence of water leakage when immersed in water to a depth of one meter IAW MIL-STD-810E NOTICE 3.

3.2.5.9 CORROSION

Internal circuitry and components shall be treated to resist corrosion and deterioration due to condensation.

3.2.5.10 SALT AND FOG

All exterior surfaces, including transit cases, shall be treated to resist corrosion or deterioration. As a minimum performance requirement, these surfaces shall exhibit no blistering, lifting of the coating system, and substrate corrosion after being subjected to a 5% sodium chloride atomized spray as described in MIL-STD-810E Notice 3, Method 509.3.

3.3 CONSTRUCTION

3.3.1 MATERIAL AND PARTS

The MILES XXI components and devices should maximize the use of commercial and non-developmental products.

3.3.2 ELECTROMAGNETIC ENVIRONMENTAL EFFORTS

Each MILES XXI component and device shall operate without being a victim to site generated or self-generated electromagnetic radiation. No component of the MILES XXI shall be a source of electromagnetic interference, when operated in its intended manner as a training device, to other site operated electronic or electrical equipment.

3.3.2.1 ELECTROMAGNETIC ENVIRONMENTAL EFFECTS (E3)

The MILES XXI equipment composed of systems, subsystems and components shall be required to operate within the electromagnetic environment generated by the MILES XXI systems and components and the existing electromagnetic environment at the intended operation/utilization sites.

3.3.2.2 INTRA-SYSTEM EMC.

The equipment shall be electromagnetically compatible with itself such that system operational performance requirements can be met. All hardware intended for field use shall be EMC with all other adjacent operating systems intended for field use.

3.3.2.3 INTER-SYSTEM EMC.

The equipment shall be electromagnetically compatible with the defined external EME such that system operational performance requirements can be met. The expected EME at the MILES XXI installations is provided in Tables 3.3.2.3.2-1 to 3.3.2.3.2-3. Inter-system EMC covers compatibility with, but is not limited to, the installation site EME, adjacent facilities and friendly emitters (other MILES equipment (MILES I, MILES 2000, MILES XXI), CB, UHF, VHF, cellular, etc.).

3.3.2.4 ELECTROMAGNETIC ENVIRONMENT(EME).

The electromagnetic environment (EME) expected at the MILES XXI utilization sites is a high electromagnetic noise environment for both radiated energy (both digital and analog emissions) and for AC power line operated conducted power line noise (both digital and analog emissions). The MILES XXI system sites are described as active military bases some of the installations sites will have an active aircraft mission. The MILES XXI sites contain electromagnetic effects from licensed/authorized radio frequency emitters, lightning storms, power line transients, and electrostatic field discharges generated by human operators and maintainers. Thus, considerable electromagnetic emissions from numerous electromagnetic emitter sources, both intentional (i.e. radar, radios both fixed and mobile) and unintentional (i.e. ignition noise, lightning storms, etc.), will be adjacent to the operating equipment. All equipment (NDI, commercial items, modified commercial items, new design, etc.) shall operate in the EME described below in Tables 3.3.2.3.2-1 to 3.3.2.3.2-3 without being a source of electromagnetic interference or a victim of electromagnetic emissions, whether radiated or conducted.

TABLE 3.3.2.3.2-1. External Electric Field EME

Frequency	Expected Operational Environment
	(V/m - rms) Average/Peak
10kHz - 2MHz	1
2MHz - 250MHz	5
250MHz - 1GHz	10
1 GHz - 10 GHz	20
10GHz - 40GHz	5

TABLE 3.3.2.3.2-2. Electrical Power EME

Power Source AC Line	Power Source Battery
Transient Peak (Volts)	
400	120

TABLE 3.3.2.3.2-3. Electrostatic Discharge EME

Interior & Exterior Levels
(kilovolts)
4

3.3.2.5 Non-DEVELOPMENTAL ITEMS (NDI) AND COMMERCIAL ITEMS

The NDI and commercial items shall meet the E3 requirements suitable for ensuring that the system operational performance requirements are met.

3.3.2.6 LIFE CYCLE E3 HARDNESS

The MILES XXI equipment operational performance and E3 requirements shall be met throughout the rated life cycle of the equipment and shall include the following: maintenance, repair, surveillance, and corrosion control.

3.3.2.7 ELECTROMAGNETIC RADIATION HAZARDS (EMRADHAZ)

The equipment design shall protect personnel, fuels, and ordnance from any hazardous effects of electromagnetic radiation generated from the MILES XXI systems or components.

3.3.2.8 OPTICAL INTERFERENCE

The MILES XXI systems shall meet the requirements for the operation (false kills) of the MILES XXI detectors to include reflection of its corresponding laser beam.

3.3.3 NAMEPLATES AND PRODUCT MARKING

The MILES XXI Nameplates shall be provided for each serialized MILES XXI system. Product markings shall be displayed prominently on the transit cases. Nameplates shall include nomenclature, part number, and a unique serial number. All remaining replaceable parts including mounting parts shall be marked with the part number. All cables shall be clearly marked with designated function, cable part number, and connector reference numbers. All assemblies with connectors shall identify the connector reference number on the body of the assembly.

3.3.4 INTERCHANGEABILITY

Interchangeability among common parts of the MILES XXI hardware and software shall be required. All parts, assemblies, and units having the same part number shall be directly and completely interchangeable.

3.3.5 SYSTEM SAFETY

Any design or modifications shall be 29 CFR 1910, and National Fire Protection Association Codes. The MILES XXI system shall provide fail-safe features for safety of personnel during installation, operation, maintenance, testing, support activities, and disposal. Commercial item equipment shall be certified as meeting the requirements of a nationally recognized safety testing laboratory (such as Underwriters Laboratory). Training equipment that can be mistaken for tactical equipment shall be marked "FOR TRAINING USE ONLY". As a minimum, the following areas shall be considered for the MILES XXI systems:

3.3.5.1 ELECTRICAL SAFETY

Electrical circuitry and installation shall comply with the requirements of the National Electric Code (ANSI/NFPA 70-02). Danger, caution, and warning signs shall be designed and used IAW ANSI/NEMA Z535.3-98 and ANSI/NEMA Z535.4-98 to warn user personnel of specific hazards such as voltage, current, and thermal. Batteries shall be sufficiently separated from electronic components to prevent damage from corrosion.

3.3.5.2 HAZARDOUS MATERIALS

The MILES XXI training system shall not incorporate any asbestos. Glass fiber materials shall not be used as the outer surface or covering on cables, wire, or other items where they may cause skin irritation to operating personnel. When maintenance procedures require access to glass fibers, such as insulation, a proper caution note shall be provided. Polyvinyl chloride (PVC) materials shall not be used in the crew compartment. Ozone-depleting substances, such as Halon, shall not be used. The MILES XXI training system shall preclude exposure of personnel or the environment to excessive levels of toxic, carcinogenic, or otherwise hazardous materials as defined by the Occupational Health and Safety Administration (OSHA), Environmental Protection Agency (EPA), and the Department of Transportation (DOT).

3.3.5.3 MECHANICAL SAFETY

Moving parts shall be guarded or provided with safety devices to prevent mechanical injury to operator and maintenance personnel. Edges and corners shall be rounded and free from burrs. Center of gravity shall be such that MILES XXI system components and devices are stable and easy to handle.

3.3.5.4 PERSONNEL SAFETY

The design shall be such as to provide maximum safety to personnel and MILES XXI training system equipment when installing, operating, adjusting, and maintaining the equipment. The MILES XXI systems shall not exceed steady state or impulse noise levels of 85 dBA for steady-state and 140 dBA for impulse noise. MILES XXI training system equipment shall be designed and installed so that it can be removed, handled, and lifted safely.

3.3.5.5 IONIZING RADIATION

If Cathode Ray Tube (CRT) monitors are used, measurements shall be taken to ensure that monitors do not have a higher x-radiation exposure rate than 0.5 milliroentgen (mR) per hour at a distance of 5 centimeters from an external point as required in section 1020.10 of Public Law 90-602, The Radiation Control for Health and Safety Act.

3.3.5.6 LASER SAFETY

Laser equipment, system design, written operator manuals, and maintenance instructions shall conform to CFR Title 21, subchapter J, part 1040. For those requirements of 21 CFR 1040 that cannot be met due to operational requirements, an exemption shall be requested from the Government and ANSI Z136.6-2000 shall be used as the design requirement for the items listed above. If exempted, the laser shall have a label of exemption from FDA standards IAW ANSI Z136.6-2000. Hazard classification shall be IAW ANSI Z136.1-2000.

a. The laser eye safety classification shall be Class 1, or Class 3a and the Nominal Ocular Hazard Distance (NOHD) shall not exceed the following:

Unaided viewing	-10 meters
Aided Viewing (using 7 power optics)	- 50 meters

b. Labeling shall be IAW ANSI Z136.6-2000, according to the hazard classification, and placed such that it is clearly visible. The wording contained in the upper block of the warning design shall be consistent with the perceived hazard.

3.3.5.7 RADIOACTIVE MATERIAL RESTRICTION IN OPTICAL PRODUCTS

The optical products shall contain no thorium or other source materials, as defined by 10 CRF 40, in excess of 0.05 percent by weight (500 ppm), or other radioactive materials. Optical products are defined as optical glass constituents or raw materials, optical glass components such as windows, filters, reflectors, prisms, beamsplitters, lens elements and fiber optics, optical assemblies, and optical coatings, except for IR objective lenses. Radioactive materials are defined as radioactive material per item in excess of concentrations or in quantities greater than 0.001 microcuries.

3.3.6 HUMAN ENGINEERING

The detail design and functionality of the MILES XXI training system shall be IAW the following sections of MIL-STD-1472: Control 5.1 (Control/display integration); 5.2 (Visual displays); 5.3 (Audio displays); 5.4 (Controls); 5.5 (Labeling); 5.6 (Anthropometry); 5.9 (Design for maintainance); 5.11.1 Portability of Load Carrying; 5.13 (Hazards and safety); 5.15 (User-computer interface).

3.3.6.1 SPEECH INTELLIGIBILITY

Speech Intelligibility requirements shall be IAW MIL-STD-1472. Intelligibility of synthetic speech will be measured using representative panel of listeners.

3.4 MAJOR COMPONENT CHARACTERISTICS

3.4.1 MILES XXI COMBAT VEHICLE SYSTEM

The MILES XXI Combat Vehicle System shall perform IAW the MILES XXI training system requirements and the following:

a. A MILES XXI Combat Vehicle System configuration for each of the combat vehicles as defined in Appendix A shall be required. Laser Weapon Simulators shall be provided for simulation of the primary and secondary weapons and their corresponding ranges and maximum rates of fire for each of the Combat Vehicle Systems as defined in Appendix A. The Weapon Simulators transmissions shall be triggered using normal weapon firing procedures. Each configuration shall contain Weapon Simulators, Target Systems, Target Visual Kill Status Indicator, and Combat Vehicle System to provide a means of

engagement pairing to a MILES attacker and provide lethality assessment at the Combat Vehicle System. The integration of the MILES XXI to the M2A3/M3A3 shall be IAW the M2A3/M3A3 Interface Control Document for External Training Devices 19207-1246074 REV H. The MILES XXI Combat Vehicle System for the M2/M3 ODS shall eliminate errors due to superelevation of the main gun by the vehicle fire control system. (NOTE: The Government has developed a vehicle add-on for the M2/M3 ODS which, when installed on the ODS, removes superelevation. This add-on can be made available, if required.)

b. The MILES XXI Combat Vehicle System Manworns shall be the same as the Manworn in the Independent Weapon System. The Manworns shall be provided to perform personnel casualty assessment for each of the combat vehicle crew members as defined in Appendix A.

c. The Target System of each vehicle as defined in Appendix A shall be arrayed so that the front aspect, each side aspect, and rear aspect of the turret or hull permits an aspect dependent lethality assessment. A four zone implementation shall be located on the vehicle such that a hit zone representative of the referenced combat vehicle is created.

d. The Combat Vehicle System shall incorporate an aspect dependent Pk. This includes taking into account the relationship of the vehicle's turret to hull orientation along with hit location information derived from the Target System. The Target System shall provide a means to program Pks for a direct frontal attack, left side/right side flank attacks, rear attacks, and a shot that is received by two adjacent sides of the vehicle (corner shot).

e. The vehicle's Target System shall incorporate the vehicle's Pk, the lethality of the attacker's weapon and ammunition, and the region of impact of a hit to calculate probability of a kill. The vehicle's Target System shall have programmable Pks for the assessments of a firepower kill, a mobility kill, and a communication kill, in that order, when a catastrophic kill is not assessed for a hit from an attacking weapon of the type which could cause a catastrophic kill. The Combat Vehicle System shall perform the following actions for each of the kill conditions:

(1) For a catastrophic kill, inhibit the firing of the vehicle primary weapon Laser Transmitter Unit(s), provide a visual/aural indication to the crew that a catastrophic kill has been assessed, and initiate a catastrophic kill target visual kill indication.

(2) For a firepower kill, inhibit the firing of the primary weapon Laser Transmitter Unit, provide a visual/aural indication to the crew that a firepower kill has been assessed, and initiate a firepower kill target visual kill indication.

(3) For a mobility kill, provide a visual/aural indication to the crew to stop vehicle motion and initiate a mobility kill target visual kill indication. 20 seconds after the crew has received notification of a mobility kill from the Target System, the Combat Vehicle System

shall initiate a cheat kill if it senses vehicle motion. For a cheat kill, the Combat Vehicle System shall perform the same functions as the catastrophic kill defined in (1) above.

(4) For a communication kill, provide a visual/aural indication to the crew that a communication kill has been assessed and initiate a communication kill target visual kill indication. The Combat Vehicle System shall not disable or interrupt the internal or external vehicle communication.

f. The Combat Vehicle System's Target System shall assess a hit when no type of kill is assessed from an attacking weapon that could cause a kill.

g. The Combat Vehicle System's Target System shall assess a catastrophic kill if a mobility kill and a firepower kill have been assessed from two separate engagements.

h. The Combat Vehicle System shall perform the following actions in response to a corresponding electronic signal received by the Target System through the data transfer interface.

(1) Perform a hit assessment and assess the appropriate catastrophic kill, firepower kill, mobility kill, communication kill, or hit

(2) Perform an administrative kill, which includes the same actions as a catastrophic kill

(3) Indicate a near miss

(4) Reset the Combat Vehicle System

(5) Resurrect the Combat Vehicle System

(6) Synchronize the internal clock

(7) Modify the Pk table of the Combat Vehicle System's Target System

(8) Run BIT

(9) Modify the System's PID.

i. The vehicle's Target System shall inject voice cues into the vehicle intercom system to communicate the assessment of near misses, hits, and catastrophic, firepower, mobility, and communication kills. The Target System shall be capable of operating with either the AN/VIC-1 or AN/VIC-3 Vehicle Intercommunication Systems, except that only the AN/VIC-3 shall be required for the M2A3/M3A3.

j. The M1/A1 and M1/A2 Combat Vehicle Systems shall provide the means for the selection of ammunition type on a round by round basis for the gunner and loader, track ammunition quantities, and compare gunner/loader ammunition selections for all primary weapons. If the selection of the gunner and loader does not match, only “near-miss” words shall be sent by the Shooter. The M2 Combat Vehicle System shall provide the means for the selection of ammunition type on a round by round basis for the gunner and track ammunition quantities for all primary weapons. The Combat Vehicle System shall display at each loader station and at the Control Unit, upon command, ammunition selected, ammunition remaining, and reloading status. The Combat Vehicle System shall perform the following additional functions:

(1) Decrement the remaining ammunition count when the corresponding Laser Transmitter Unit is fired.

(2) Inhibit the Laser Transmitter from transmitting the MILES code if a weapon firing is initiated when the vehicle’s ammunition load has been expended. (Gunner selection of COAX weapon shall not require loader interaction or matching.)

k. The Combat Vehicle System’s Laser Transmitter(s) shall generate, upon activation of the trigger or firing electronic signal of the 120mm, 25mm, and TOW and the firing of blanks by the M240 coax primary weapon, the encoded laser beam(s) to implement the Enhanced MILES Communication Code IAW PMT 90-S002G. For the 120mm, 25mm, and the TOW weapons, actual weapon fire signal shall be used.

l. The MILES XXI CVS shall store on-board an OPFOR PID, a BLUEFOR PID, and a minimum of 64 vehicle types and their corresponding ammunition types, ammunition basic loads, and vulnerability tables as defined in Appendix B. The PIDs and vehicle types shall be retained in memory such that they are available for selection by authorized personnel upon power up as part of the Combat Vehicle’s system initialization. The System shall have 26 predefined vehicle types embedded into the system, and 38 user-defined vehicle types that can be overwritten by downloading additional vehicle types and their vulnerability tables to the system.

m. The Control Unit shall be located inside the vehicle’s crew area.

n. The Target System shall initiate the target visual kill status indicator to give the visual indications for each corresponding event. The visual indication shall perform as follows:

(1) Shall be visible through 360 degrees in azimuth.

(2) Shall provide a flash visible at a distance of not less than 1800 meters in full sun lit standard clear day, as defined in Figure 1, with the unaided eye.

(3) Shall flash at a rate of 1.0 ± 0.1 Hz.

o. The Combat Vehicle System shall provide a signal to activate the MGSS. The MGSS interface shall provide the following:

(1) Generation of a firing command in response to a simulated 120mm weapon firing initiated by the crew.

(2) A safety interlock to eliminate accidental firing of the WESS during maintenance or boresight.

p. The Combat Vehicle System shall provide a signal to the DIFCUE when a catastrophic kill has been assessed. The DIFCUE interface shall provide:

(1) Generation of a firing command in response to a catastrophic kill assessment by the System.

(2) A safety interlock to eliminate accidental firing of the weapon effects simulator during maintenance.

q. The time required for the vehicle's crew to perform mounting, system check-out, and boresighting of the Combat Vehicle System shall be less than one hour. The time required for the vehicle crew to remove the Combat Vehicle System shall take one hour or less.

r. If a common laser transmitter unit mounted on the 25 mm gun is used to simulate the TOW and the 25 mm gun, errors due to loose coupling between the TOW launcher and the 25 mm gun shall be corrected. (NOTE: for the M2/M3A2 and M2/M3 ODS vehicles an ISU Workaround box, which directs the TOW reticle and Gunner controls to the main gun, when the vehicle is in TOW mode, was developed by the Government and can be made available.)

s. The M2/M3 Combat Vehicle System shall include a WESS assembly that provides visual cues to simulate a TOW missile firing. The CVS System shall prevent firing of the simulated TOW if an unfired M22 cartridge is not loaded. The WESS assembly shall provide the following:

(1) Visual flash and smoke events similar to that of the missile being fired.

(2) A safety interlock to eliminate accidental firing of the weapon effects simulator.

(3) Use of the standard M22 cartridge.

t. The M2/M3 Combat Vehicle System shall generate a firing command to the WESS in response to a simulated TOW weapon firing initiated by the crew.

u. The M2\M3 Combat Vehicle System shall include a FlashWESS assembly that provides a visual cue to simulate the firing of the 25 mm weapon. The FlashWESS assembly shall:

(1) Provide a lamp flash that operates at a rate of fire of the weapon being simulated up to a maximum of 200 flashes per minute.

(2) Provide a flash that is visible at a distance of 1000 meters in a full sun lit standard clear day, as defined in Figure 1, with the unaided eye.

(3) Not use a pyrotechnic in the FlashWESS.

v. The M2\M3 Combat Vehicle System shall generate a firing command to the FlashWESS in response to a simulated firing of their respective 25 mm weapon.

w. The MILES XXI Combat Vehicle System secondary weapon Laser Transmitter(s) shall meet the requirements of the Individual Weapon System.

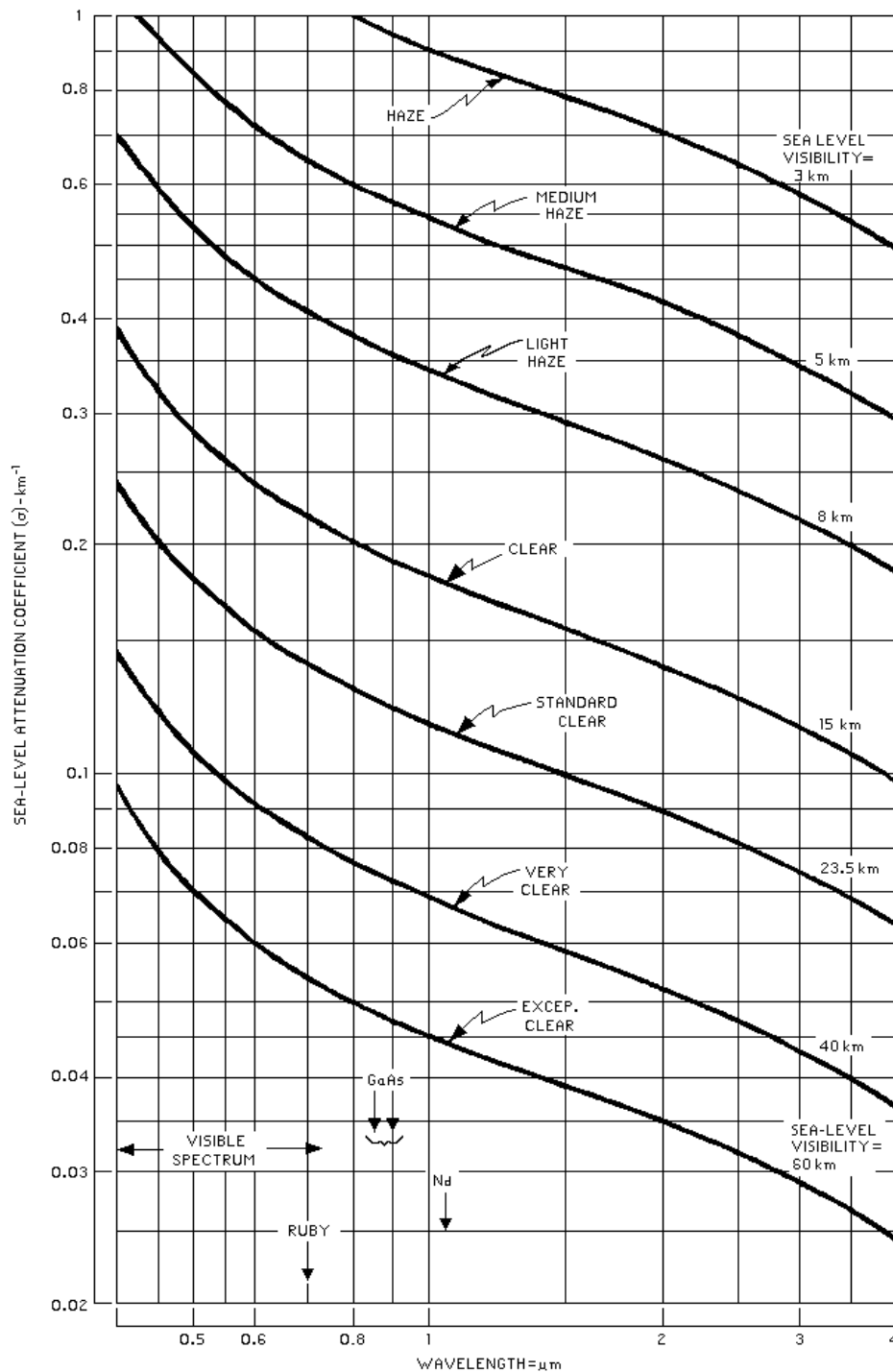


FIGURE 1. STANDARD CLEAR DAY

Approximate variation of attenuation coefficient with wavelength at sea level for various atmospheric conditions. Neglects absorption by water vapor and carbon dioxide.

3.4.2 MILES XXI INDEPENDENT TARGET SYSTEM

The Independent Target System shall perform IAW the MILES XXI training system requirements and the following:

- a. A MILES XXI Independent Target System configuration for each of the targets listed in Appendix A is required. Each configuration shall provide a means of engagement pairing to a MILES attacker and lethality assessment at the Independent Target System.
- b. Each Independent Target System listed in Appendix A shall be configured such that a hit zone representative of the M966 TOW HMMWV target is created.
- c. The Independent Target System shall use the target's Pk and the lethality of the attacker's weapon and ammunition to assess weapon effects on a target. For Independent Target System configurations, the Independent Target System shall have programmable Pks for the assessments of a mobility kill or communications kill if a catastrophic kill is not assessed when a hit resulted from an attacking weapon of the type which could cause a catastrophic kill. The Independent Target System shall perform the following actions for each of the kill conditions listed below:
 - (1) For a catastrophic kill, provide a visual/aural indication to the individuals associated with the target and initiate a catastrophic kill target visual kill indication.
 - (2) For a mobility kill, provide a visual/aural indication to the crew to stop vehicle motion and initiate a mobility kill target visual kill indication. Twenty seconds after the crew has received notification of a mobility kill, the Independent Target System shall initiate a catastrophic kill if it senses vehicle motion. For a cheat kill, the Independent Target System shall perform the same functions as the catastrophic kill.
 - (3) For a communications kill, provide a visual/aural indication to the individuals associated with the target that a communications kill has been assessed and initiate a communications kill target visual kill indication.
- d. The Independent Target System shall perform the following actions in response to a corresponding electronic signal received by the Target System through the data transfer interface:
 - (1) Perform a lethality assessment and assess the appropriate catastrophic kill, mobility kill, communications kill, or hit
 - (2) Perform an administrative kill
 - (3) Indicate a near miss

- (4) Reset the Independent Target System
- (5) Resurrect the Independent Target System
- (6) Synchronize the internal clock
- (7) Modify the Pk table of the Independent Target System
- (8) Run BIT
- (9) Modify the System's PID

e. The MILES XXI ITS shall store on-board an OPFOR PID, a BLUEFOR PID, and a minimum of 64 vehicle types and their corresponding ammunition types, ammunition basic loads, and vulnerability tables as defined in Appendix B. The PIDs and vehicle types shall be retained in memory such that they are available for selection by authorized personnel upon power up as part of the ITS initialization. The System shall have 26 predefined vehicle types embedded into the system, and 38 user-defined vehicle types that can be overwritten by downloading additional vehicle types and their vulnerability tables to the system.

f. The Control Unit shall be located inside the cab/drivers areas for wheeled vehicles. The Control Unit shall be located inside the turret/crew area for tracked vehicles.

g. The Independent Target System shall provide visual/aural indications when the unit assesses a kill, hit, or near-miss.

h. The time required for an individual to perform mounting and system check-out of the Independent Target System shall be one hour or less. The time required for an individual to remove the Independent Target System shall take one hour or less.

3.4.3 MILES XXI CREW SERVED WEAPON SYSTEM

The CSWS shall consist of a TOW Tracker Head Assembly and a TOW Simulator Tube which shall install onto the tactical Traversing Unit and Tripod with a TOW Launcher Tube. The Crew Served Weapon System shall perform IAW the MILES XXI training system requirements and the following:

- a. Shall provide a Crew Served Weapon System configuration for each of the weapons listed in Appendix A. Each configuration shall provide a means of engagement pairing to a MILES attacker and lethality assessment at the Crew Served Weapon System.
- b. The Crew Served Weapon System shall generate, upon reception of a firing signal, the electronic signals to encode the MILES XXI Laser Transmitters to transmit the Enhanced MILES Communication Code IAW PMT-90-S002G.

- c. The Target System of each Crew Served Weapon System listed in Appendix A shall be mounted such that a hit zone representative of the Crew Served Weapon is created, as specified IAW the requirements of the MILES XXI Target System.
- d. When the Crew Served Weapon System has assessed that a weapon kill has occurred the firing of its corresponding Laser Transmitter shall be inhibited.
- e. The Crew Served Weapon System shall contain a device that generates a 74 +14/-6 dB audible signal 24 inches from the signal source each time the system determines either a near miss assessment or a kill assessment IAW 3.2.1.2(e). The kill assessment signal shall stop after the Crew Served Weapon System has inhibited the firing of its Laser Transmitter. Each of the two near miss assessment signal shall be 0.3 up to 1.0 seconds in duration.
- f. If the actual components of the crew served weapon being simulated are not utilized, the simulated components shall exhibit the actual weapon's characteristic size, weight, and feel.
- g. The Crew Served Weapon System ammunition's simulated time of flight shall be adjustable in its initiation process. The time of flight shall be consistent with the Standard for MILES Communication Code Structure, PMT-90-S002G, as it applies to guided missiles.
- h. The Crew Served Weapon System shall include a WESS assembly that provides visual cues, flash, and smoke to simulate a missile firing. The WESS assembly shall meet the same requirements as the M2/M3 CVS TOW.
- i. The Crew Served Weapon System shall provide a triggering signal to the WESS assembly in response to a simulated weapon firing initiated by the crew.
- j. The Crew Served Weapon System shall provide an indication to the operator that the missile track time has been completed.
- k. The Crew Served Weapon System shall, upon being reset, return to full operational status, default to a preprogrammed ammunition load, and, if in the kill mode, emit an audio signal indicating that it has been reset.
- l. The Crew Served Weapon System shall perform the following functions in response to a corresponding electronic signal received by the Crew Served Weapon through the data transfer interface.
- (1) Perform a catastrophic kill
 - (2) Perform an administrative kill
 - (3) Indicate a near miss

- (4) Reset the Crew Served Weapon System
- (5) Resurrect the Crew Served Weapon System
- (6) Synchronize the internal clock
- (7) Modify the Pks of the Crew Served Weapon System
- (8) Run BIT
- (9) Modify the System's PID

m. The TOW Crew Served Weapon System shall simulate missile tracking requirements IAW PMT-90-S002G.

n. The Crew Served Weapon shall store on-board and utilize in its MILES engagements an OPFOR PID, a BLUEFOR PID, ammunition type, ammunition basic load, ammunition delay time, and Pk Tables as specified in Appendix D. The PIDs shall be retained in memory such that they are available for selection by authorized personnel upon power up as part of the Crew Served Weapon system initialization. The system shall retain the information in semi-permanent memory that can be overwritten by downloading additional information from the AAR System.

o. The Crew Served Weapon Systems shall perform the following functions:

- (1) Display ammunition remaining.
- (2) Decrement the remaining ammunition count when a round is fired.

(3) Inhibit the Laser Transmitter from transmitting and the WESS from firing if a weapon firing is initiated when the ammunition load has been expended.

p. The TOW Crew Served Weapon shall simulate the TOW day sight and interface with the existing TOW night sight.

3.4.4 MILES XXI INDIVIDUAL WEAPON SYSTEM

The Individual Weapon System shall perform as an Individual Weapon system IAW the MILES XXI TESS performance requirements and the following:

a. An Individual Weapon System configuration for each of the weapons as defined in Appendix A is required. Each configuration shall provide a means of engagement pairing to a MILES attacker and lethality assessment at the Individual Weapon System.

- b. The Individual Weapon System shall be capable of being fired by any individual with a MILES XXI Manworn Unit that is not in a kill casualty assessment mode. The Laser Transmitter shall transmit the PID of the associated person operating the Individual Weapon System.
- c. Shall have a dry fire trigger unit to provide the ability to activate the weapon mounted Laser Transmitter without firing blank ammunition. The dry fire trigger unit shall meet the rain, sand and dust environmental requirements.
- d. Shall have a selectable mode of operation, not dependent on blanks, for use in aligning the laser output with the weapon sighting and for testing. This dry-fire mode shall require controller personnel interaction for selection and shall not be independently available to the weapon operator.
- e. Shall operate with blanks as a normal operating condition when mounted on an individual operator weapon. The Individual Weapon System shall generate, upon firing of the blank, the electronic signals to encode the MILES XXI Laser Weapon Simulator(s) to implement the Enhanced MILES Communication Code IAW PMT 90-S002G. When not in a dryfire mode, the laser simulation of a round or burst of rounds shall be fired only when activated by the firing of blank rounds.
- f. Have no interconnecting cables between the Laser Transmitter and the other components of the Individual Weapon System.
- g. Shall provide an indication to the operator that pairing transmission has occurred in response to the firing of a blank round or a trigger pull when in dry-fire mode.
- h. The M24 Laser Transmitter Unit shall transmit the M16 MILES weapon code parameters as specified in of PMT-90-S002G.
- i. The M249 Squad Automatic Weapon (SAW) Laser Transmitter Unit shall transmit the M60 MILES weapon code parameters as specified in PMT-90-S002G.
- j. The M240 Laser Transmitter Unit shall transmit the M60 MILES weapon code parameters as specified in PMT-90-S002G.
- k. The time required to perform mounting and boresighting of the Individual Weapon System shall be 15 minutes or less. Use of night vision devices by the soldier shall not impede the boresighting of the Laser Transmitter.
- l. Provide an Individual Weapon System's Manworn Unit that shall:
 - (1) Assess a kill or near-miss when the Target System receives and decodes a MILES coded signal and determines the appropriate action IAW PMT-90-S002G. The manworn Pk values for the manworn, with and without body armor, to stored and utilized in

the casualty assessment are as specified in Appendix E. All Pk values shall be externally programmable.

(2) Inhibit the wearer from firing any Individual Weapon and Surrogate Weapon System when the Target System has assessed that a kill has occurred.

(3) Have no external power switch. Removal of the power source shall cause a soldier to be assessed as a cheat kill. The Target System shall have a time delay of at least two but not more than three minutes before assessing a cheat kill to allow for battery replacement.

(4) Perform the following actions in response to a corresponding electronic signal received by the Manworn through the data transfer interface.

- (a) Perform a kill
- (b) Perform an administrative kill
- (c) Indicate a near miss
- (d) Reset the Manworn Unit
- (e) Resurrect the Manworn Unit
- (f) Synchronize the internal clock
- (g) Modify the Pks of the Manworn Unit
- (h) Run BIT
- (i) Modify the System's PID

(5) Contain a device that shall generate a 74 +14/-6 dB audible signal 24 inches from the signal source, for not less than five seconds, each time the Manworn determines a kill assessment. When the Manworn determines a near miss assessment, the device shall emit a 0.3 up to 1.0 second 74 dB +14/-6 dB signal as specified for the MILES XXI Target System.

(6) Stop the kill assessment signal after the Manworn Unit has inhibited the individual wearing the Manworn Unit from firing the Laser Transmitter Unit of an Individual Weapon System and Surrogate Weapon System.

(7) Be mounted such that a hit zone representative of an infantry soldier is created as specified for the MILES XXI Target System

(8) Return to full MILES XXI operational status upon decoding of a reset or resurrection MILES code word.

(9) Contain a data display located on the Manworn Unit as specified for the MILES XXI Target System. The display shall be readable by the wearer and by observer/controllers standing at a distance of two feet from the manworn.

(10) Have no direct mechanical connection, including electrical wire links, between any item on the helmet, weapon, and soldier's torso.

(11) Provide the detectors, sound device, power supply, and processors into a single lightweight harness that shall not interfere with the soldier's Light Forces Vest, load bearing equipment (LBE), or Modular Lightweight Load-bearing Equipment (MOLLE).

(12) Store on-board the Manworn an OPFOR PID, BLUEFOR PID, and Pks. The PIDs shall be retained in memory such that they are available for selection by authorized personnel upon power up as part of the Manworn Unit's initialization. The Manworn shall retain the information in semi-permanent memory that can be overwritten by downloading additional information from the AAR System.

(13) Can be used with body armor and with both the Kevlar helmet and softcap headgear.

3.4.5 MILES XXI SURROGATE WEAPON SYSTEM

The Surrogate Weapon System shall perform IAW the MILES XXI TESS requirements, and the following:

- a. Shall provide a Surrogate Weapon System configuration for the weapon as defined in Appendix A.
- b. Shall generate, upon reception of a firing signal, the electronic signals to encode the MILES XXI Laser Transmitter Unit(s) to implement the Enhanced MILES Communication Code IAW PMT-90-S002G. The AT-4 Laser Transmitter Unit shall transmit MILES weapon code 15, ammunition types C, D, G, and H, parameters as specified in PMT-90-S002G.
- c. If the actual components of the surrogate weapon being simulated are not utilized, the simulated components shall exhibit the actual weapon's characteristic size, weight, and feel.
- d. The Surrogate Weapon System shall include a WESS assembly that provides visual cues, flash, and smoke to simulate a rocket firing. The WESS assembly shall meet the requirements of the M2/M3 CVS TOW.
- e. The Surrogate Weapon System shall provide a triggering signal to the WESS assembly in response to a simulated weapon firing initiated by the operator.
- f. The AT-4 Laser transmitter shall transmit only when an unfired WESS is connected and fired by the WESS firing device.
- g. The Surrogate Weapon System's Laser Transmitter Unit(s) shall be capable of being fired by any individual with a Manworn Unit who is not in a kill casualty assessment

mode. The Laser Transmitter Unit(s) shall transmit the PID of the associated person operating the Surrogate Weapon System.

h. The AT-4 Surrogate Weapon ammunition default load shall be adjustable to allow up to nine rockets. This function shall not be independently available to the soldier operating the weapon.

i. The AT-4 Surrogate Weapon System shall perform the following functions:

(1) Display rockets remaining.

(2) Decrement the remaining rocket count when a rocket is fired.

3.4.6 CONTROLLER DEVICE

The Controller Device shall be a self-contained unit which shall transmit a message to each target at the ranges listed below in atmospheric conditions the same as for the MILES XXI shooter. The Controller Device shall provide, from remote positions, the following administrative functions:

a. Kill or near miss a Combat Vehicle System, Independent Target System, Crew Served Weapon System, and Manworn Unit using the universal kill code or miss code respectively for a minimum range of 500 meters IAW PMT 90-S002G.

b. Transmit the Optical Reset Code to reset a previously killed Combat Vehicle System, Independent Target System, Crew Served Weapon System, and the Manworn Unit for a minimum range of 500 meters. The MILES code assignment of the reset word code shall be MILES code number 36 as defined in PMT 90-S002G .

c. Transmit an Optical Resurrection Code to resurrect a previously killed Combat Vehicle System, Independent Target System, Crew Served Weapon System, and the Individual Weapon System for a minimum range of 500 meters. The MILES code assignment of the resurrection word code shall be MILES code number 30 as defined in PMT 90-S002G .

d. Provide a time programmable internal clock. The clock shall have day, month, year, and time, in military format, synchronized to 30 seconds accuracy in a 96 hour period.

e. Transmit a laser beam signal to synchronize remotely the Target System's internal clock to the clock in the Controller Device for a minimum range of 100 meters.

f. Select and transmit the Enhanced MILES weapon codes as defined in PMT 90-S002G for a minimum range of 100 meters.

- g. Decode and display the MILES transmitted code and PID of the MILES XXI, MILES 2000, and Basic MILES Laser Transmitter Units for a minimum range of 20 meters.
- h. Modify the System's PID

3.4.7 AAR SYSTEM

The AAR System shall provide the following functions:

- a. Upload information to the MILES Shooter and Target System to initialize it with specific information to uniquely identify its performance capabilities. Data to be uploaded includes weapon type(s), ammunition loads, and vulnerability data commensurate with the system on which the device will be installed.
- b. Downloaded data from the MILES Shooter and Target System including all event data.

3.4.7.1 UPLOAD/DOWNLOAD/INITIALIZE TIME

The AAR System shall take no more than three minutes to perform any of the following functions for the MILES XXI systems:

- a. Uploading of all needed data, to include sets of vulnerability tables.
- b. Initialize.
- c. Downloading all stored event data.

3.4.7.2 AAR SYSTEM STORAGE REQUIREMENTS

The AAR System shall be capable of storing the information required to initialize a minimum of 25 MILES XXI devices. Additionally, the AAR System shall also be capable of storing the downloaded event records of a minimum of 25 MILES XXI devices. Not more than 50% of the AAR System storage medium shall be utilized to meet this requirement.

3.4.7.3 PERSONAL COMPUTER (PC) COMPATIBILITY

The AAR System shall include either a light-weight portable computer, a Personal Digital Assistant (PDA), or an interfacing device to a PC such that data to be uploaded to the MILES XXI device can be generated on a PC and the data retrieved from the MILES XXI device can be read into and manipulated by a PC with the AAR System software. The AAR System interface unit shall meet the environmental requirements of Rain and Sand & Dust.

3.4.7.4 AAR SYSTEM SOFTWARE

The AAR software program shall provide the following capabilities:

- a. Accept all recorded event data.
- b. Provide the following AAR reports:
 - (1) A list of each MILES XXI system's downloaded event records.
 - (2) A list of all fratricide incidents and the associated PIDs.
 - (3) A list of each of the downloaded MILES XXI system's lethality assessment events and the associated event information.
 - (4) A list of each of the downloaded MILES XXI system's firing events and the associated event information.
 - (5) A list of each of the downloaded MILES XXI system's cheat events and the associated event information.
 - (6) A list of each of the downloaded MILES XXI system's administrative events and the associated event.
- c. The ability for the AAR operator to generate ad hoc reports using the downloaded data.

3.4.8 "ANCILLARY DEVICES",

3.4.8.1 BORESIGHT AND ALIGNMENT DEVICE(S)

The Laser Transmitter Units of the Combat Vehicle System, Crew Served Weapon System, and Surrogate Weapon System shall be capable of being boresighted and aligned to the host weapon platforms to allow the systems to perform as specified. If these boresighting requirements include a Boresight and Alignment Device(s), they shall be stand-alone device(s). Once aligned, the above-referenced MILES XXI system electronics and software components shall maintain alignment for at least ten hours under the environmental conditions described in this document.

3.4.8.2 ORGANIZATIONAL TEST SET(S)

If the MILES XXI Combat Vehicle System does not perform BIT to line replaceable unit level, an organizational test set(s) shall be provided. The test set(s) shall be a small, portable test instrument used to fault isolate MILES XXI systems to the line replaceable unit level. The unit(s) shall be ruggedized for field use.

4 VERIFICATION

4.1 DESIGN VERIFICATION

The matrix in Table I specifies the methods of verification for each of the requirements of Section 3. The Qualification Methods of Table I are defined as follows:

- a. Examination (E). Examination is an element of inspection consisting of investigation, without the use of special laboratory appliances or procedures, of supplies and services to determine conformance to those specified requirements that can be determined by such investigations. Examination is generally nondestructive and includes, but is not limited to, the use of sight, hearing, smell, touch, and taste; simple physical manipulation; mechanical and electrical gauging and measurement; and other forms of investigation.
- b. Testing (T). Testing is an element of inspection and generally denotes the determination, by technical means, of the properties or elements of supplies, or components thereof, including functional operation, and involves the application of established scientific principles and procedures. Test shall consist of measurement, calculation, and other accepted scientific means to establish that the performance requirements of this Specification are met.
- c. Analysis (A). Analysis shall be performed through the review of applicable and adequate documentation to verify that the specified requirements have been met. Verification shall be by mathematical analysis, statistical analysis, sampling the correlation of measured data, and observing test results with calculated expected values, conformance of end items with Contractor-generated specifications and documentation from lower tier supplies, as well as Government-approved configuration item specifications and documentation.
- d. Demonstration (D). Demonstrations will be performed through actual exercise of the item to verify that the specified requirements have been met.
- e. Certification (C). Certification is an element of inspection to verify that the requirement has been met. Certifications must include documented test results, performance data, analytical data, or vender documentation. The certifications must be made available to Government representatives immediately upon request for review during inspections.

TABLE I. Method of Verification			
Requirement Paragraph	Paragraph Title	Test Paragraph	Qualification Methods

3.1.2	MILES XXI Interface	N/A	T
3.1.2.1	Basic MILES Interface	N/A	A,D,E,T
3.1.2.2	Operator Interface	N/A	A,D,E,T
3.1.2.3	Data Transfer Interface	N/A	A,D,E
3.1.2.4	Host Interface	N/A	A,D,E
3.1.2.4.1	Vehicle Internal Communication Interface	N/A	A,D,E
3.1.2.4.3	Weapon System Trigger Interface	N/A	A,D,E
3.1.2.4.4	Mechanical Interface	N/A	A,D,E
3.1.2.5	DIFCUE Interface	N/A	A,D,E
3.1.2.6	MGSS Interface	N/A	A,D,E
3.2.1	System Performance	N/A	A,D,E,T
3.2.1.1	Shooter	N/A	A,D,E,T
3.2.1.2	Target System	N/A	A,D,E,T
3.2.1.3	BIT Characteristics	N/A	A,D,E,T
3.2.1.4	Computational System Requirements	N/A	A,D,E
3.2.1.4.1	Operational Computer System(s)	N/A	A,D,E,T
3.2.1.4.2	Operational System Software	4.2.1	A,D,E
3.2.1.4.2.1	Software Development Requirements	4.2.1.1	A,D,E,C
3.2.1.4.2.2	Run Time Environment	N/A	A,D
3.2.1.4.2.3	Firmware	4.2.1.2	A,D,E,T,C
3.2.1.5	False Alarm Rate	N/A	A,D,T
3.2.1.6	Installation and Removal Requirements	N/A	A,D,E
3.2.1.7	Mounting	N/A	A,D,E
3.2.1.7.1	Mounting Devices	N/A	A,D,E
3.2.1.8	Interfacing Cabling	N/A	A,D,E
3.2.1.9	Transit Case(s)	4.2.2	A,E,T
3.2.2.1	Weight	N/A	A,T
3.2.2.2	Size	N/A	A,E
3.2.2.3	Power	N/A	A,D
3.2.2.3.1	Power Control	N/A	A,D
3.2.2.3.2	Power Operation	N/A	A,D,T
3.2.2.3.3	Batteries	N/A	A,D,E
3.2.2.4	Finish	N/A	A,E,T
3.2.2.5	Color	N/A	E
3.2.2.6	Transportability	4.2.3	A,D,E,T
3.2.3	Reliability	4.2.4	T
3.2.4	Maintainability	4.2.5	A,D
3.2.5	Environmental conditions	4.2.6	N/A
3.2.5.1	High Temperature	4.2.6.1	A,T

3.2.5.2	Low Temperature	4.2.6.2	A,T
3.2.5.3	Shock	4.2.6.3	A,T
3.2.5.4	Vibration	4.2.6.4	A,T
3.2.5.5	Humidity	4.2.6.5	A,T
3.2.5.6	Rain	4.2.6.6	A,T,C
3.2.5.7	Sand and Dust	4.2.6.7	A,T
3.2.5.8	Immersion	4.2.6.8	A,T
3.2.5.9	Corrosion	4.2.6.9	A,E
3.2.5.10	Salt/Fog	4.2.6.10	A,T,C
3.3.1	Material, processes and parts	N/A	C
3.3.2	Electromagnetic Environmental Efforts	4.2.7	A,T
3.3.2.1	Electromagnetic Environmental Effects	4.2.7.1	A,T
3.3.2.2	Intra-system EMC	4.2.7.2	A,T
3.3.2.3	Inter-system EMC	4.2.7.3	A,T,D
3.3.2.4	Electromagnetic Environment	N/A	D
3.3.2.5	Non-developmental items (NDI) and commercial items	4.2.7.4	A,T,D
3.3.2.6	Life cycle, E3 hardness	4.2.7.5	D
3.3.2.7	Electromagnetic radiation hazards (EMRADHAZ)	4.2.7.6	A,D,E,T
3.3.2.8	Optical Interference	N/A	D
3.3.3	Nameplates and product marking	N/A	E
3.3.4	Interchangeability	4.2.8	D,E,T
3.3.5	System Safety	4.2.9	A,D,E,T
3.3.5.1	Electrical Safety	4.2.9.1	A,D,E,T
3.3.5.2	Hazardous Materials	4.2.9.2	A,C,E
3.3.5.3	Mechanical Safety	4.2.9.3	A,D,E,T
3.3.5.4	Personnel Safety	4.2.9.4	A,D,E,T
3.3.5.5	Ionizing Radiation	4.2.9.5	A,D,E,T
3.3.5.6	Laser Safety	4.2.9.6	A,D,E,T
3.3.5.7	Radioactive Material Restriction in Optical Products	4.2.9.7	A,C,E
3.3.6	Human engineering	N/A	A,D,E
3.3.6.1	Speech Intelligibility	N/A	A,D,T
3.4.1	MILES XXI Combat Vehicle System	N/A	A,D,E,T
3.4.2	MILES XXI Independent Target System	N/A	A,D,E,T
3.4.3	MILES XXI Crew Served Weapon System	N/A	A,D,E,T
3.4.4	MILES XXI Individual Weapon System	N/A	A,D,E,T

3.4.5	MILES XXI Surrogate Weapon System	N/A	A,D,E,T
3.4.6	Controller Device	N/A	A,D,E,T
3.4.7	AAR System	N/A	A,D,E,T
3.4.7.1	Upload/Download Time	N/A	A,D
3.4.7.2	AAR System Storage Requirements	N/A	A,D
3.4.7.3	PC Compatibility	N/A	A,D,E
3.4.7.4	AAR System Software		N/A
3.4.8	Ancillary Devices	N/A	A,D,T
3.4.9	Organizational Test Set	N/A	A,D,T

4.2 VERIFICATION METHODS

The verification methods shall be on hardware systems and subsystems to ensure compliance with the following characteristics. If a Specification characteristic is identical for several subsystems, Approval may be obtained to perform qualification on a representative subsystem.

4.2.1 OPERATIONAL SYSTEM SOFTWARE

The software shall be examined to ensure that it meets the MILES XXI TES requirements.

4.2.1.1 SOFTWARE DEVELOPMENT REQUIREMENTS

The Contractor shall certify that the software developed for the MILES XXI uses established software engineering methodologies.

4.2.1.2 FIRMWARE

The Contractor shall certify that any firmware developed meets the same developmental requirements as the software. The code and documentation shall be visually examined to ensure compliance.

4.2.2 TRANSIT CASES

The MILES XXI system level transit cases shall be tested to ensure protection of MILES XXI unit components during transportation, storage, and handling. The transit cases shall be verified by testing to ensure they meet the requirements of: High Temperature, Low Temperature, Shock, Vibration, Rain, and Corrosion.

4.2.3 TRANSPORTABILITY

The transportability requirements shall be verified by analysis, demonstration, certification, and examination. Verification that the MILES XXI hardware does not exceed the weight and

balance envelope shall be by demonstration and analysis. Verification that the MILES XXI components and support equipment are housed in designated containers shall be by analysis and examination. Label requirements shall be verified by examination.

4.2.4 RELIABILITY

The reliability requirements shall be verified by a Reliability Qualification Test (RQT). The RQT shall be conducted in accordance with an RQT Plan.

4.2.5 MAINTAINABILITY

A MTTR of 60 minutes or less for each MILES XXI system and device shall be verified by demonstration.

4.2.6 ENVIRONMENTAL CONDITIONS

The environmental requirements shall be considered verified after successful completion of the following tests: high temperature, low temperature, shock, vibration, humidity, rain, sand and dust, leakage, corrosion, and salt fog. The component parts, units, and subassemblies of MILES XXI shall operate and be stored under the conditions described below:

- a. Arrange if desired to allow the post-test inspection and operational checkout for preceding test to serve as the pre-test inspection and operational checkout for the next test.
- b. Perform tests on a selected sample of each type MILES XXI equipment. In the event of a failure of a sample to satisfactorily complete a test, the Contractor shall inspect every component of that type for the presence of a fault responsible for failure and shall correct such fault prior to randomly selecting the next sample for retest. No percentage defective is allowable.
- c. Unmodified, stand-alone commercial equipment which is covered for repair or replacement by an original equipment manufacturer's warranty and/or which is tested to MIL-STD-810E Notice 3 requirements equal or higher than specified herein shall be certified as conforming without necessity for additional environmental testing.

4.2.6.1 HIGH TEMPERATURE

The High Temperature requirements shall be verified by test IAW MIL-STD-810E Notice 3, Method 505.3, Procedure I, for all externally-mounted components. Internally and externally-mounted components shall be tested IAW accordance with MIL-STD-810E Notice 3, Method 501.3, Procedure I - Storage. The internally-mounted components shall be tested IAW MIL-STD-810E Notice 3, Method 501.3, Procedure II - Operating. The following conditions shall apply:

Procedure I - Solar Radiation Operating

- a. The high temperature requirement shall be +49 degrees C for operation and 1120 W/m².
- b. The test unit shall be fully assembled into its operation state, with power applied.
- c. Temperature sensors shall be located on the exterior surface of the test unit.
- d. The test shall consist of three 24 hour cycles.
- e. An operational check-out shall be conducted during the period of maximum response in each temperature cycle and at the conclusion of the test.

Procedure I - Storage

- a. The high temperature storage requirement shall be +70 degrees C.
- b. The test unit shall be properly packaged and in its storage configuration.
- c. The temperature sensors shall be located on the exterior surface of the test unit.
- d. The test shall be conducted for seven cycles (each cycle shall be 24 hours in duration).
- e. An operational check-out shall be conducted at the conclusion of the test.

Procedure II - Operation

- a. The high temperature requirement shall be +49 degrees C for operation.
- b. The test unit shall be fully assembled into its operation state, with power applied.
- c. Temperature sensors shall be located on the exterior surface of the test unit.
- d. The test shall consist of three 24 hour cycles.
- e. An operational check-out shall be conducted during the period of maximum response in each temperature cycle and at the conclusion of the test.

4.2.6.2 LOW TEMPERATURE

The Low Temperature requirements shall be verified by test IAW MIL-STD-810E Notice 3, Method 502.3, Procedures I (Mild Cold, Induced for 24 hours), MIL-STD-810E Notice 3, Method 502.3 Procedure II (Basic Cold, Operational, for three cycles), and the following

conditions:

Procedure I - Storage

- a. The low temperature storage requirement shall be -33 degrees Celsius.
- b. The test unit shall be properly packaged and in its storage configuration.
- c. The temperature sensors shall be located on the exterior surface of the test unit.
- d. The test shall be conducted for three cycles (24 hours).
- e. An operational check-out shall be conducted at the conclusion of the test.

Procedure II - Operation

- a. The low temperature requirement shall be -18 degrees Celsius for operation.
- b. The test unit shall be fully assembled into its operation state.
- c. Temperature sensors shall be located on the exterior surface of the test unit.
- d. The test shall consist of three 24 hour cycles.
- e. An operational check-out shall be conducted at the last hour of each 24 hour cycle and at the conclusion of the test.

4.2.6.3 SHOCK

The Shock requirements shall be verified by test IAW MIL-STD-810E Notice 3, Method 516.4 Procedure I - Functional Shock, Figure 516.4-4. Components and devices in their transit cases shall also be subjected to the recommended drop test of Table 516.4-II and Procedure IV - Transit Drop.

- a. The test unit system shall be fully assembled into its operation state for Procedure I.
- b. For Procedure I, use the Operational Test For Ground Equipment test shock response spectrum of Figure 516.5-10.
- c. An operational check-out shall be conducted at the conclusion of the test.

4.2.6.4 VIBRATION

Any system component that is used on more than one vehicle shall be verified once using

the vibration program data of the most severe platform. The Vibration requirements shall be verified IAW MIL-STD-810 as follows:

Method 514.5, Category 20 (Ground Mobile):

- a. The test unit shall be fully assembled into its operational state.
- b. The narrowband random-on-random vibration program data defined by the table listed in Table II shall be used.
- c. The M1A1 vibration test phases shall be run for 60 minutes and the M113 vibration test phases shall be run for 40 minutes, for a test time of 240 minutes per axis, and a total test time of 12 hours.
- d. An operational check-out shall be conducted at the conclusion of the test.

Vehicle System	MIL-STD-810E Notice 3 APPENDIX A Table	Table Description
M1 Series Tanks	514.4-AIV	M1A1 Tank Wegman Hull Rack
M2/M3 Bradley *	514.4-AXIX	M113 Crew Compartment Walls
M113 APC	514.4-AXIX	M113 Crew Compartment Walls
Independent Target System	514.4-AII	Secured Cargo Transportation, Composite Wheeled Vehicle

Table II

* The Universal Laser Transmitters (ULT) for the M2/M3 Bradley shall undergo the M1A1 Tank Wegman Hull Rack testing.

Method 514.4, Category 3 (Loose Cargo)

- a. The Individual Weapon System components, Controller Gun and AAR system shall be assembled in their operational mode, without transit cases. The Crew Served Weapon System components, Surrogate Weapon System components, and Small Arms Alignment Fixture shall be assembled in their transit case transport mode.
- b. Procedure III - Category 3 - Loose cargo transport shall be performed for a duration

of 30 minutes.

- c. An operational checkout shall be performed at the conclusion of the test.

4.2.6.5 HUMIDITY

The Humidity requirements shall be verified IAW MIL-STD 810E Notice 3, Method 507.3 Procedure I (Natural), Cycle 3, with the following requirements:

- a. The test unit shall be fully assembled into its operation state.
- b. The test cycle used shall be as defined by Figure 507.3-I.
- c. Each cycle shall be 24 hours in duration.
- d. The test duration shall be for ten cycles with a quick look and operational check-out after the fifth cycle.
- e. For "Group C" testing, the duration shall be two cycles.
- f. An operational check-out shall be conducted at the conclusion of the test.

4.2.6.6 RAIN

The Rain requirements shall be verified by test IAW MIL-STD-810E Notice 3, Method 506.3 Procedure I - Blowing Rain. The test unit shall be subjected to the following limits:

- a. The test unit shall be fully assembled into its operation state.
- b. The rainfall rate shall be a minimum of four inches per hour.
- c. The wind velocity shall be a minimum of 40 miles per hour.
- d. The temperature of the test unit shall be at least ten degrees Celsius greater than the rain temperature at the beginning of each 30 minute exposure period.
- e. The test shall be conducted for a period of 30 minutes per face until all faces have been exposed.
- f. The failure criteria shall be degradation of performance of the test unit following the rain test and unconditional failure as defined in MIL-STD-810E Notice 3, Method 506.3, paragraph I-4.1.2.
- g. An operational check-out shall be conducted at the end of the test.

- h. The transit case requirement shall be verified by the above test procedure or through certification, by manufacturer, of analogous test procedures and data.

4.2.6.7 SAND AND DUST

The Sand and Dust requirements shall be verified by test IAW MIL-STD-810E Notice 3, Method 510.3, when subjected to the following limits (Test items shall be powered on during test):

- a. Sand. The test unit shall be tested IAW MIL-STD-810, Method 510.3, Procedure II, for blowing sand, and with the following requirements:
 - 1. The test unit shall be fully assembled into its operation state and all optics, windows and front panels shall be protected.
 - 2. The sand particle size shall be from 0.15 to 0.85 millimeters and the concentration of 1.1 grams per cubic meter.
 - 3. The air velocity in the test chamber shall be from 18 to 29 meters per second.
 - 4. The test shall be conducted for a period of 90 minutes per face until all faces have been exposed.
 - 5. An operational check-out shall be conducted at the conclusion of the test.
- b. Dust. The test unit shall be tested IAW MIL-STD-810, Method 510.3, Procedure I for blowing dust, and with the following requirements:
 - 1. The test unit shall be fully assembled into its operation state.
 - 2. The dust particle size shall be from 0.0001 to 0.01 millimeters and the concentration of 10.6 grams per cubic meter.
 - 3. The air velocity in the test chamber shall be 8.9 meters per second.
 - 4. The test shall be conducted for six hours at +23 degrees Celsius and six hours at +49 degrees Celsius, with an operational check conducted during the second test period.
 - 5. An operational check-out shall be conducted at the conclusion of the test.

4.2.6.8 IMMERSION (LEAKAGE)

The Immersion requirements shall be verified IAW MIL-STD 810E Notice 3, Method 512.3, Procedure I - Basic Leakage.

- a. The test unit shall be fully assembled into its operation state and the following:
- b. The test unit temperature shall be stabilized to 27 degrees C above the water temperature, with the water temperature at 18 ± 10 degrees C.
- c. The immersion depth shall be one meter and immersion period of two hours.
- d. Observations for air bubbles originating from the unit shall be done.
- e. After completion the test unit shall be examined for water content inside the unit. Evidence of water penetration into the test unit following the immersion test or not completing the operational check-out at the conclusion of the test shall be basis for failure.

4.2.6.9 CORROSION

The Corrosion requirements shall be verified by examination and analysis.

4.2.6.10 SALT AND FOG

The Salt and Fog requirements shall be verified IAW MIL-STD-810E Notice 3, Method 509.3 for Salt Fog climatic tests, and with the following requirements:

- a. The test unit shall be fully assembled into its operation state.
- b. The solution concentration shall be five percent \pm one percent.
- c. The test unit shall be exposed alternating 48-hour periods of salt fog exposure and drying conditions for a minimum of four 48-hour periods (two wet and two dry).
- d. An operational check-out shall be conducted at the conclusion of the test.
- e. Failure criteria shall be any noticeable corrosion or blistering on the interior or exterior of the test unit, or failure to properly perform during the operational check-out at the conclusion of the test.
- f. The transit case requirement of 4.2.2 shall be verified by the above test procedure or through manufacturer certification of analogous test procedures and data.

4.2.7 ELECTROMAGNETIC ENVIRONMENTAL EFFECTS (E3).

The safety critical functions shall be verified to be electromagnetically compatible with the E3 generated by the MILES XXI systems/ subsystems/components and with installation site

electromagnetic environments prior to operator use at the MILES XXI installation sites.

4.2.7.1 E3 VERIFICATION METHODS.

The E3 verification methods shall address the life cycle aspects of the training system/subsystems/components, including (as applicable) normal in-service operation, checkout, storage, transportation, handling, packaging, loading, unloading, and the normal operating procedures associated with each aspect.

4.2.7.2 INTRA-SYSTEM EMC.

All MILES XXI systems, subsystems and components shall be EMC with all other versions of MILES equipment utilized at the MILES XXI sites. Compliance shall be verified by system/subsystem/component-level test(s) (laboratory and/or field), demonstrations, analysis, or a combination of these methods.

4.2.7.3 INTER-SYSTEM EMC.

All MILES XXI systems, subsystems and components shall be EMC with all other electronic, electrical, electromechanical equipment intended operation at the same time the MILES XXI equipment is in operation. Compliance shall be verified by system level test(s) (laboratory and/or field), demonstrations, analysis, or a combination of these methods.

4.2.7.4 NON-DEVELOPMENTAL ITEMS (NDI) AND COMMERCIAL ITEMS.

All MILES XXI systems, subsystems and components compliance shall be verified by test(s) (laboratory and/or field), demonstrations, analysis, or a combination of these methods.

4.2.7.5 LIFE CYCLE, E3 HARDNESS.

Compliance of MILES XXI equipment shall be verified by test(s), analysis, inspection(s), or a combination of these methods. The ability to detect maintainability, accessibility, and testability degradations shall be demonstrated.

4.2.7.6 ELECTROMAGNETIC RADIATION HAZARDS (EMRADHAZ).

Compliance of the MILES XXI equipment that none of the systems, subsystems, or components present hazards to fuel, personnel, and ordnance shall be verified by test, demonstrations, analysis, inspections, or a combination of these methods.

4.2.8 INTERCHANGEABILITY

The Interchangeability requirement shall be verified by a test that shall demonstrate interchangeability of circuit card assemblies, spare part assemblies, and devices. A functional test or demonstration of fit shall be conducted after each interchangeability trial.

No degradation of performance shall be allowed. Verification shall include certification that all circuit card assemblies, spare parts, and devices are fit, function and interface interchangeable with MILES XXI devices.

4.2.9 SYSTEM SAFETY

The Contractor shall verify the following requirements of each configuration described in Appendix A and the System Safety requirements of this Specification. By analysis, examination, demonstration and test, the Contractor shall complete and verify compliance to the applicable items on the safety checklist provided in Appendix C. The System Safety requirements shall be considered verified after successful completion of requirements outlined in Table I along with those stated in this Section.

4.2.9.1 ELECTRICAL SAFETY

The Contractor shall verify by analysis, examination, demonstration, and test that the electrical circuitry and installation meet applicable requirements of the National Electrical Code (ANSI/NFPA 70-93). The Contractor shall provide a list of all danger, caution, and warning signs installed in the MILES XXI equipment and incorporated into applicable Technical Manuals (TM) and Publications. This list, which shall include design and wording of each sign IAW ANSI/NEMA Z535.3-91/Z535.4-91, shall be attached to Appendix C. The completed safety checklist-Appendix C shall be submitted and demonstrated to the Government as part of physical safety inspections of each MILES XXI major component. The Contractor shall verify by analysis and test that the installation, operation, handling, and maintenance of batteries used with the MILES XXI equipment does not present safety or health hazards for user personnel or damage associated equipment.

4.2.9.2 HAZARDOUS MATERIALS

The Contractor shall confirm by analysis, examination, and certification that the MILES XXI equipment does not incorporate any asbestos or ozone-depleting substances, that glass fiber materials are not used as the outer surface or covering on cables, wire, or other items where they may cause skin irritation to operating personnel, and that PVC materials are not used in the crew compartments. The Contractor shall demonstrate by analysis and certification that the MILES XXI training system does not expose personnel or the environment to unacceptable levels of toxic, carcinogenic, or otherwise hazardous materials as defined by OSHA, EPA, or DOT. The Contractor shall attach to the completed Appendix C any applicable Material Safety Data Sheets along with any required warning signs on equipment and procedures/warnings in TMs and Publications.

4.2.9.3 MECHANICAL SAFETY

The Contractor shall verify by analysis, examination, demonstration, and test that any moving parts of the MILES XXI equipment are properly guarded or provided with safety devices to prevent injury to operator and maintenance personnel, that any edges or corners are

rounded and free from burrs, and that the MILES XXI equipment's center of gravity is such that components and devices are stable and easy to handle. The Contractor shall attach to Appendix C any applicable warning signs to equipment or warnings to related TMs and publications.

4.2.9.4 PERSONNEL SAFETY

The Contractor shall verify by analysis, demonstration, examination, and test that the MILES XXI noise generating devices do not exceed impulse and steady state noise level requirements defined in this Specification. The Contractor shall also verify by analysis, examination, demonstration, and test that the MILES XXI equipment meets safety and health requirements of MIL-STD-1472, paragraphs 5.9.11.3, 5.9.11.5, and 5.13. The Contractor shall attach to the completed Appendix C the design and wording of warning signs installed in equipment along with warnings incorporated into TMs and publications as related to personnel safety.

4.2.9.5 IONIZING RADIATION

The Contractor shall verify by analysis, demonstration, examination, and test that, IAW Section 1020.10 of Public Law 90-602, no x-radiation equipment has an exposure rate higher than 0.5 mR per hour at a distance of five centimeters from an external point. The Contractor shall attach to the completed Appendix C the design and wording of warning signs installed in equipment along with warnings incorporated into TMs and publications as related to ionizing radiation.

4.2.9.6 LASER SAFETY

The Contractor shall verify by analysis, demonstration, examination, and test that laser equipment, system design, written TMs, and maintenance instructions meet the requirements of CFR Title 21, subchapter J, Part 1040. The Contractor shall submit an exemption to, and obtain an approval from, the Government to those requirements of 21 CFR 1040 that can not be met due to operational requirements in accordance to laser safety requirements defined in Laser Safety of this Specification. IAW ANSI Z136.1-2000, the Contractor shall install on the equipment applicable laser safety labels along with incorporating applicable warnings in TMs and publications. The Contractor shall attach to the completed Appendix C the design and wording of warning labels and warnings as related to laser safety.

4.2.9.7 RADIOACTIVE MATERIAL RESTRICTIONS IN OPTICAL PRODUCTS

The Contractor shall verify by analysis, examination, and certification that the MILES XXI equipment does not incorporate any thorium or other source materials, or other radioactive materials as defined in Radioactive Material Restriction in Optical Products of this Specification. The Contractor shall attach to the completed Appendix C any applicable Material Safety Data Sheets along with any required warning signs on equipment and procedures/warnings in the TMs and Publications.

4.2.10 TARGET VISUAL KILL STATUS OBSERVATION

The Target Visual Kill Status Indicator shall be positioned six feet above the ground. Observation for flash shall be made with at least five non-Contractor personnel positioned 1800 meters distance. At least one observer shall be a Government representative. The test shall be conducted during standard clear conditions. The observer shall be notified prior to each firing in order to alert them to watch for the flash. The observers shall also be notified after each flash to inform them that the flash took place, allowing for them to record their observations. Observations shall be recorded as visible or non-visible. Three out of five of the observers must record a visible observation for the flash to be deemed visible.

4.3 FIRST ARTICLE INSPECTION

First article inspection shall be performed on initial production samples. Approval of the first article by the Government shall not relieve the contractor of the obligation to supply MILES XXI systems that are fully representative of those inspected as a first article sample. Any changes or deviation of the production units from the first article sample shall be subject to the approval of the contracting officer.

5 PACKAGING

5.1 PACKAGING

For acquisition purposes, the packaging requirements shall be as specified in the contract. When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6 NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 ADAPTABILITY

The MILES XXI system shall be adaptable to weapon systems currently under development and future weapon systems for which detailed data on configuration, lethality, and other weapon/platform data is not yet available.

6.2 ABBREVIATIONS AND ACRONYMS

The following list of abbreviations and acronyms are stated in this Specification.

ABBREVIATION	TERM
AAR	After Action Review
AC	Alternating Current
AEL	Accessible Emission Limit
ANSI	American National Standards Institute
ATA	Air Transport Association
BIT	Built In Test
CRF	Code of Federal Regulations
CSCI	Computer Software Configuration Item
CVS	Combat Vehicle System
DIFCUE	Direct/Indirect Fire Cue
DOD	Department of Defense
DOT	Department of Transportation
DSL	Document Summary List
E3	Electromagnetic Environmental Effects
EMC	Electromagnetic Compatible
EME	Electromagnetic Environment
EPA	Environmental Protection Agency
HMMWV	High Mobility Multipurpose Wheeled Vehicle
IAW	In Accordance With
IEEE	Institute of Electrical and Electronic Engineers
I/O	Input/Output
IR	Infrared Red
ITS	Independent Target System
IWS	Individual Weapon System
MCC97	MILES Communication Code
MGSS	Main Gun Signature Simulator
MILES	Multiple Integrated Laser Engagement System
MR	Milliroentgen
MTBEFF	Mean Time Between Essential Functional Failure
MTTR	MEAN Time to Repair
NDI	Non-Developmental Item
OSHA	Occupational Health and Safety Administration
PC	Personal Computer
PDA	Personal Digital Assistant
PID	Player Identification
Pk	Probability of kill
PVC	Polyvinyl chloride
RETS	Remote Target System
SAW	Squad Automatic Weapon

ABBREVIATION	TERM
STRICOM	Simulation, Training, and Instrumentation Command
TES	Tactical Engagement Simulation
TM	Technical Manuals
TOW	Tube-launched Optically-tracked Wire-guided Missile
WESS	Weapon Effects Signature Simulator

APPENDIX A -- MILES XXI SYSTEM CONFIGURATIONS

MILES XXI Combat Vehicle Systems

A MILES XXI Combat Vehicle System configuration shall be required for each of the following combat vehicles:

- a. M1 Abrams series tanks. (M1A1, M1A2, and M1A2 SEP configurations)

Primary Weapons	Basic Load	Maximum Firing Rate	Effective Range	Suppression Range
120 mm				
APFSDS round (Ammo Type= A&E)	28	12 RPM	3000M	N/A
HEAT round (Ammo Type=B&F)	12	12 RPM	3000M	N/A
M240 (7.62 mm Coax)	9900	650 RPM	800M	1600M
Secondary Weapons				
M240 (7.62mm)	N/A	650 RPM	800M	1100M
M2 (12.7mm; turret type for the M1A1)	N/A	650 RPM	1000M	1800M

Manworn Quantities: 4 each

- b. M2/M3 Bradley series fighting vehicles. (M2/M3A2, M2/M3A2 Operation Desert Storm (ODS), and M2/M3A3 configurations)

Primary Weapons	Basic Load	Maximum Firing Rate	Effective Range	Suppression Range
M242 (25mm)				
APDS round (Ammo Type=A&E)	350	200 RPM	3000M	N/A
HEAT round (Ammo Type=B&F)	1150	200 RPM	3000M	N/A
TOW-II	15	N/A	3750M	N/A
M240 (7.62mm Coax)	2400	650 RPM	800M	1600M

Manworn Quantities: 3 each

- c. M113A3 Armored Personnel Carrier

Primary Weapons	Basic Load	Maximum Firing Rate	Effective Range	Suppression Range
N/A	N/A	N/A	N/A	N/A
Secondary Weapons				
M2 (12.7 mm)	N/A	650 RPM	1000M	1800M

Manworn Quantities: 2 each

MILES XXI Independent Target Systems

A MILES XXI Independent Target System configuration shall be required to be used with the following independent targets:

- a. M977 - HEMTT
- b. D7G - Dozer
- c. FLU 419 Small Emplacement Excavator (SEE)
- d. M60A1 AVLB
- e. M992 - Ammunition Carrier
- f. M88A1 - Recovery Vehicle
- g. M728 - CEV
- h. MW24C - Case
- i. M1009 - CUCV ¾ Ton
- j. M578 - Recovery Vehicle, Light
- k. Generators
- l. M109A6 - Howitzer, 155mm SP
- m. M35A2 - Truck, Cargo, 2 ½ Ton Series
- n. M939A1/A2 Series - Truck, Cargo, 5 Ton Series
- o. M978 - Truck, Tank Fuel Servicing
- p. M998A2 - HMMWV (Versions: M1097A2, M1025A2, M1035A2, M1043A2, M1045A2, M997A2, XM1109, XM113, XM114)
- q. Heavy fortified structures - Bunkers
- r. Light Fortified Structures - Buildings, Bridges
- s. M996 - TOW Carrier
- t. M9 - ACE

MILES XXI Crew Served Weapon System

A MILES XXI Crew Served Weapon System Configuration shall be required for the following weapon:

Weapon	Basic Load	Reload Time Delay	Max Effective Range
TOW II	4 RNDS	30 sec	3750M

MILES XXI Individual Weapon System

A MILES XXI Individual Operator Weapon System configuration and associated manworn shall be required for the following weapons:

Weapon	Maximum	Effective	Suppression
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		Firing Rate	Range	Range
a.	M16A2/M4 (w&w/o M203)	650 RPM	550M	N/A
b.	M24 Sniper Rifle	15 RPM	1000M	N/A
c.	M249 SAW short/long barrel	725 RPM	800M	N/A
d.	M2	650 RPM	1000M	1800M
e.	M240B	650 RPM	800M	1100M

MILES XXI Surrogate Weapon System

A MILES XXI Surrogate Weapon System configuration shall be required for the following weapon:

Weapon	Basic Load (Rounds)	Reload Time Delay	Effective Range
AT4	N/A	N/A	300M

APPENDIX B – Combat Vehicle/Independent Target vulnerability tables

Separately Attached

APPENDIX C -- SYSTEM SAFETY DESIGN VERIFICATION CHECKLIST

Applicability

This checklist is provided as guidance for design safety requirements of MILES 2000, DIFCUE, MGSS and the associated Pyrotechnic configurations of this procurement action. It is intended for use in contractor's concurrent engineering process and during Government safety inspections.

Instructions

- (1) Select the sections of this checklist that apply to the item to be inspected.
- (2) Review each question. Eliminate those that do not apply by marking **NA** (not applicable) or add any applicable questions that were not included.
- (3) Evaluate each applicable question and record conformance or non-conformance by a **Y** (Yes) or **N** (No), respectively.
- (4) Remarks should include a discussion on how it is in conformance or non-conformance.

SECTION 1: ELECTRICAL SAFETY

- 1.1 Are operating personnel protected from accidental contact with voltages in excess of 30 volts?
- 1.2 Does each contact, terminal or like device, having voltages between 70 and 500 volts, rms or DC, with respect to ground, have barriers or guards to minimize accidental contact by operating or maintenance personnel?
- 1.3 Are barriers or guards that protect terminals or like devices exhibiting 70-500 volts, clearly marked to indicate highest voltage encountered upon its removal?
- 1.4 Are portions of assemblies operating at potentials above 500 volts, RAMS or DC, completely enclosed from the remainder of the assembly, and is the enclosure provided with non-bypassable interlocks?
- 1.5 Are enclosures for potentials, which exceed 500 volts, marked "DANGER, HIGH VOLTAGE, XXX VOLTS", in black on a yellow background?
- 1.6 Do all circuits and capacitors discharge to 30 volts or less within no more than two seconds after power is removed?
- 1.7 If the answer to question 1.6 is **NO**, are the high-voltage capacitors or circuits

automatically discharged when the case or rack is opened?

1.8 Are test points provided in equipment where measurement of potentials in excess of 300 volts is required?

1.9 Are test points designed to require plug-in, not clamp-on, test instruments?

1.10 Are green indicator lamps provided to indicate "power on"?

1.11 Is sufficient space provided between shield endings and exposed conductors to prevent shorting or arcing?

1.12 Are electrical conductors designed to prevent insertion of the wrong plug into a receptacle or other mating unit?

1.13 Are plugs and receptacles coded and marked to clearly indicate mating connectors, where those of similar configuration are in close proximity?

1.14 Are plugs and receptacles designed to preclude electrical shock and burns while being disconnected?

1.15 Are male plugs de-energized when disconnected?

1.16 Are dissimilar plug/receptacle pairs used in units containing explosives?

1.17 When equipment is designed to operate on more than one type of input power, does the connector design prevent connection or use of improper power?

1.18 Are single-phase power cables properly color coded:
Black: hot; White: neutral; Green: ground?

1.19 Are three-phase power cables coded as in Question 1.18, above, with the second and third phases in red and blue, respectively?

1.20 Are meter terminals protected from voltages of 70 volts or more?

1.21 Do probes that are part of or accessories to the equipment contain safety guards that prevent contact with the tip and is the length of the exposed portion of the tip not more than 0.75 inches? (This question does not apply if the voltages to be measured are less than (a) 30 volts rms, (b) 60 volts DC, or (c) 24.8 volts DC interrupted at a rate of 10 Hz to 200 Hz.)

1.22 Are current and voltage overload protection devices provided?

1.23 Except for antennas and transmission line terminals, are all external parts, surfaces, and shields at ground potential at all times?

- 1.24 Is the path from the equipment to ground continuous and permanent?
- 1.25 Is the ground wire color coded green or green with yellow stripes?
- 1.26 Does the ground have capacity to safely conduct any currents that might be imposed thereon?
- 1.27 Is the ground wire separate from electrical circuits, i.e., not tied to neutral?
- 1.28 Has a test been conducted to determine the amount of leakage current on the grounding conductor? If **YES**, indicate the amount of current, in milliamperes, that was measured.
- 1.29 Is the impedance of the path from the equipment tie point to ground sufficiently low to limit the potential drop and to allow the operation of over-current devices in the circuits?
- 1.30 Does the path from the equipment tie point to ground have sufficient mechanical strength to minimize accidental ground disconnection?
- 1.31 Is the ground connection to the chassis or frame secured by one of the following: Spot welded terminal lug, Soldering lug, Screw, nut, and lockwasher?
- 1.32 through 1.34 - DELETED
- 1.35 Are both the phase and neutral supply voltage lines not connected to the chassis?
- 1.36 Are wires and cables supported and terminated to prevent shock and fire?
- 1.37 Are DC power connections color coded and marked for polarity?
- 1.38 Does the main power switch cut off all power to the complete equipment?
- 1.39 Is the main power switch clearly identified?
- 1.40 Is the main power switch located on the front panel?
- 1.41 Is physical protection provided from accidental contact with the power input side of the main power switch and the incoming power line connections?
- 1.42 Are power switches located such that they cannot be operated by accidental contact?
- 1.43 Are switches provided to deactivate mechanical drive units without disconnecting other parts of the equipment?

1.44 Are means provided to cut off power while installing or replacing an item of equipment or an assembly or part thereof?

1.45 Are emergency controls readily accessible and clearly identified?

1.46 Does the equipment use batteries? If **YES**, indicate whether batteries are the primary or backup power source.

1.47 Is the battery in the Government inventory? If **YES**, indicate the battery's nomenclature, e.g., BA-xxx, BB-xxx, etc.

1.48 Has U.S. Army Communications and Electronics Command (CECOM) approved the battery assignment?

1.49 Can the battery enclosure or box prevent injury or damage in the event of a violent gas venting or rupture of the battery cells?

1.50 Are battery compartments vented?

SECTION 2: MECHANICAL SAFETY

2.1 Are safety covers provided for exposed gears, cams, levers, fans, and belts?

2.2 - DELETED

2.3 Are positive means provided to prevent mismatching of fittings?

2.4 Are doors and drawers and associated catches, hinges, supports, fasteners, and stops designed to prevent accidental injury?

2.5 Is the installed equipment free of overhanging edges and corners that may cause injuries?

2.6 Is the equipment likely to remain upright under normal use and in strong wind, considering its means of support and center of gravity?

2.7 Does the weight of equipment that is designed to be carried by a single soldier not exceed the following limits?

<u>Handling Function</u>	<u>Weight (lbs)</u>	
	<u>Male & Female</u>	<u>Male Only</u>
Equipment designed to be lifted from	37	56

the floor to five feet
or less above the floor.

Equipment designed to be lifted from the floor to three feet or less above the floor	44	87
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Equipment designed to be carried 33 feet or less.	42	82
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2.8 Does the weight distribution allow easy handling, moving, and positioning?

2.9 Are suitable carrying handles provided?

2.10 Are lifting requirements labeled on equipment weighing over 37 lbs?

2.11 Are safety relief valves provided for pressurized systems or components?

2.12 Is all glass of the non-shatterable type?

SECTION 3: ENVIRONMENTAL SAFETY

- 3.1 Is the temperature of all exposed parts less than 60°C, when the ambient temperature is 25°C, regardless of the condition of operation?
- 3.2 Is the temperature of front panels and operating controls less than 49°C, when the ambient temperature is 25°C, regardless of the condition of operation?
- 3.3 Is the release of toxic, corrosive, or explosive fumes or vapors prevented?
- 3.4 Are the outer coverings of cables, wires, and other components free of glass fiber materials?

SECTION 4: RADIATION SAFETY

- 4.1 Are warning labels provided that indicate the hazardous range of microwave emissions for components that produce a power density in excess of the following limits?

Frequency (f) (MHz)	Power Density mW/cm ²
0.01 - 3	100
3 - 30	900/f ²
30 - 100	1
100 - 1,000	100
1,000 - 300,000	10

- 4.2 Have tests verified no radium or other radioactive materials are present?
(MIL-STD-454M, Rq 1 [4.8.3])
- 4.3 Are radiation markings and labels affixed to all parts or components producing microwave, radio frequency or laser radiation?
- 4.4 Are filters, goggles, or other protective devices provided, and are warning signs posted, for all sources of radio frequency, ultraviolet, infrared, high-energy visible, laser, and any other type of hazardous radiant energy?
- 4.5 - DELETED
- 4.6 Is either an FDA classification label or a DA Label 168 affixed to each laser device?

SECTION 5: OTHER SAFETY

5.1 Is equipment designed to prevent accidental ignition of hazardous atmospheres? (Applicable to equipment that is intended for use in atmospheres of explosive gas or vapors, combustible dusts, or ignitable fibers and flyings.)

5.2 Is a shut-down device or an alarm provided to prevent injury or equipment damage?

5.3 Is there adequate separation between critical warning lights and other lights?

5.4 Are audible warning signals distinguishable from other sounds under normal operating conditions?

5.5 Are warning circuits separate from control circuits?

QUESTIONS 5.6 THROUGH 5.14 PERTAIN TO SYSTEM SOFTWARE. SOFTWARE INCLUDES FIRMWARE. THE TERM HARDWARE INCLUDES THE SYSTEM OR EQUIPMENT AND ALL SUBSYSTEMS AND COMPONENTS.

5.6 Is the system or equipment free of software that (a) could create a hazard, (b) controls hazardous processes or outputs, or (c) controls information upon which the operator must rely in order to make safe decisions? If **YES**, then skip questions 5.7 through 5.14.

5.7 Does the software adequately control all hazardous routines and outputs?

5.8 Does the software allow the operator to take control over the hardware at any time? If the answer is **YES**, then skip question 5.9.

5.9 Does the software allow the operator to take control over the hardware when hazardous routines or outputs are involved?

5.10 Will operator have information needed in order to make safe decisions without reliance upon information generated by the software? If **YES**, skip 5.11.

5.11 Is the probability that the software will fail to provide information needed by the operator in order to make safe decisions at an acceptably low level?

5.12 Is the probability that the software will induce a critical hazard at an acceptably low level?

5.13 Can the failure of any input or output device cause a critical hazard?

5.14 Does the system assume or revert to a safe state upon a power failure or upon the failure of any hardware component, such as the primary computer?

SECTION 6: HEALTH HAZARDS

6.1.a. Are noise levels less than 85 dBA for steady state or 140dBp for impulse? If your response is no, answer question b.

b. Are appropriate warnings and/or safeguards provided on the equipment and in the technical manuals?

6.2.a. Are hazardous or potentially hazardous materials(e.g., toxics, flammables, ignitables, corrosives, reactives, explosives, oxidizers, carcinogens) used or required (operation, maintenance and/or storage)? If your response is yes, answer questions b, 6.3, and 6.4.

b. Can non-hazardous materials be substituted?

6.3 Are potential exposures to hazardous materials during use, maintenance, and disposal controlled to levels below the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL), American Conference Of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV), and/or National Institute of Occupational Safety and Health (NIOSH) Recommended Exposure Limits (REL) (use the most stringent standard)?

6.4 Is personal protective equipment (PPE) required for use of any identified hazardous materials?

6.5 Is the shelter required to be occupied during normal operations?

6.6 Is the vehicle required to be occupied during normal operations of the shelter?

6.7.a. Is the shelter air conditioned and/or heated to prevent heat and cold stress to occupants? If your response is yes, answer question b.

b. Is the system's ECG sufficient to maintain temperatures within the shelter between 60-86 degrees F?

6.8.a. Is lighting required within the shelter? If yes, answer question b.

b. Are light levels within the shelter sufficient to conduct normal operations?

6.9.a. Is the shelter powered by a generator, vehicle, etc? If your response is yes, answer question c.

b. Are personnel required to be in or near vehicles with generators operating and/or the vehicle engine idling during normal operating conditions? If your response is yes, answer question c.

c. Do the diesel exhaust levels within the shelter or vehicle exceed permissible limits of the following substances:?

Permissible Limits (PPM)

<u>Substance</u>	<u>8 Hr TWA</u>	<u>STEL</u>
Carbon Monoxide	35	200
Formaldehyde	0.75	2
Sulfur Dioxide	2	5
Acrolein	0.1	0.3
Nitric Oxide	25	N/A
Nitrogen Dioxide	N/A	1

6.10.a Is insulating material (e.g., asbestos, fibrous glass, mineral wool, polystyrene foam, polyurethane foam) added or incorporated into the shelter, vehicle, or equipment? If your response is yes, answer question b.

b. Are appropriate warnings and/or safeguards provided on the equipment and in the technical manuals?

6.11.a. Are ozone-depleting substances (ODS) (e.g., CFC-11, CFC-12, CFC-113, CFC-114, CFC-115, HCFC-22, HCFC-123, Halon 1211, Halon 1301, Halon 2402, Methyl Chloroform, Carbon Tetrachloride) required? (Clean Air Act). If your response is yes, answer questions b and c.

b. Class 1 ODS can not be used. Are appropriate warnings and/or safeguards provided on the equipment and in the technical manuals?

c. Can substitution with an ozone depletion potential (OPD) of 0.05 or less be used?

APPENDIX D -- CREW SERVED WEAPON PROBABILITY OF KILL TABLES

CREW SERVED WEAPONS PK FACTORS	
MILES CODES	FRONT PROBABILITY OF KILL
0	100%
1	100%
2	0%
3	0%
4	100%
5	100%
6	100%
7	0%
8	0%
9	100%
10	100%
11	100%
12	100%
13	100%
14	100%
15	100%
16	100%
17	100%
18	100%
19	100%
20	100%
21	100%
22	100%
23	100%
24	100%
25	0%
26	0%
27	100%
28	No Effect
29	Near Miss
30	Resurrect
31	No Effect
32	No Effect
33	No Effect
34	No Effect
35	Utility Code
36	Reset

APPENDIX E -- MANWORN PROBABILITY OF KILL TABLES

MANWORN PK FACTORS (No Body Armor)	
MILES CODES	FRONT PROBABILITY OF KILL
0	100%
1	100%
2	0%
3	0%
4	100%
5	100%
6	100%
7	0%
8	0%
9	100%
10	100%
11	100%
12	100%
13	100%
14	100%
15	100%
16	100%
17	100%
18	100%
19	100%
20	100%
21	100%
22	100%
23	100%
24	100%
25	0%
26	0%
27	100%
28	No Effect
29	Near Miss
30	Resurrect
31	No Effect
32	No Effect
33	No Effect
34	No Effect
35	Utility Code
36	Reset

MANWORN PK FACTORS (Body Armor)	
MILES CODES	FRONT PROBABILITY OF KILL
0	100%
1	100%
2	0%
3	0%
4	100%
5	100%
6	100%
7	0%
8	0%
9	100%
10	100%
11	100%
12	100%
13	100%
14	100%
15	100%
16	100%
17	100%
18	100%
19	100%
20	100%
21	100%
22	100%
23	100%
24	100%
25	0%
26	0%
27	100%
28	No Effect
29	Near Miss
30	Resurrect
31	No Effect
32	No Effect
33	No Effect
34	No Effect
35	Utility Code
36	Reset